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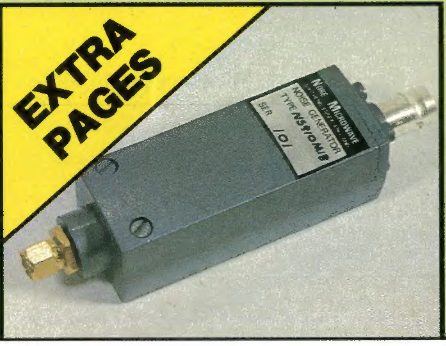

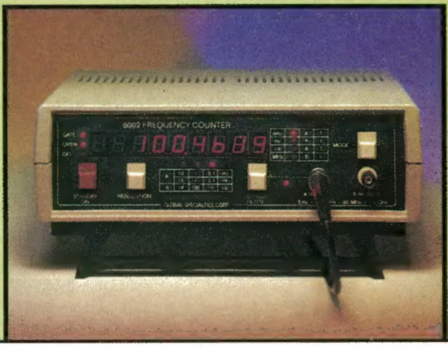

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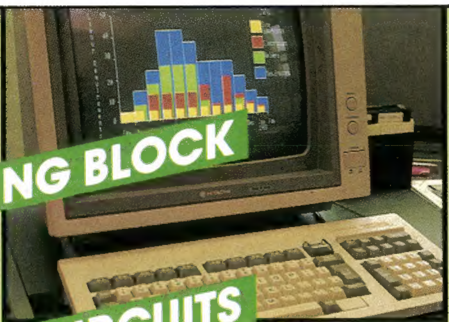

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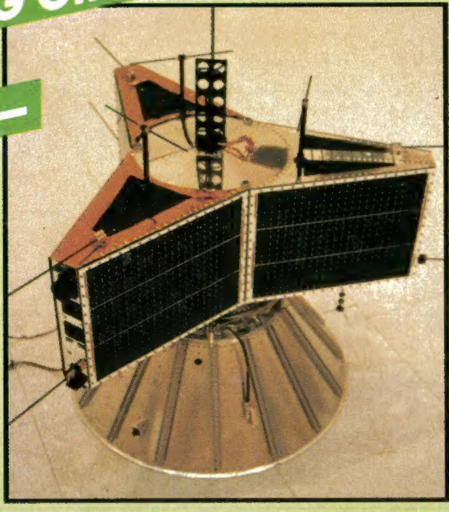

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NEW EDITOR

We are pleased to welcome Dennis Hayes as the new Editor of ***Radio & Electronics World.***

Dennis has many years of wide experience in the communications and electronics fields and is intent on producing an even better magazine.

READER SURVEY

Since taking over ***Radio & Electronics World*** we have been carrying out an extensive survey to establish exactly what you, the readers of ***Radio & Electronics World*** would like to see in your magazine each month.

The result of this survey is that the majority of readers would like to see ***Radio & Electronics World*** concentrate more on amateur radio, with an emphasis on projects to build, and we are now planning future issues to achieve this. We will be pleased to receive any further comments and suggestions you may have.

HAVE YOU THOUGHT OF BECOMING AN AUTHOR?

We are always interested in receiving articles to be considered for publication and are particularly keen to hear from anyone who has something to say related to the amateur radio field. As mentioned before, projects for fellow readers to build are most welcome.

You don't need to be an expert writer. If you can get your ideas down on paper, preferably typed, with drawings that we can follow and photographs where relevant, we will sort out the style, grammar, spelling, etc.

If you have an idea for an article, or have designed and built a project that you think others would be interested in, but still have doubts about becoming an author, why not write (giving brief details and your *telephone number*) or telephone Dennis Hayes . . . and of course you will be paid for your effort.

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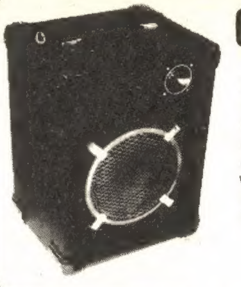
OMP 80 LOUDSPEAKER



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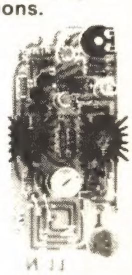

3 watt FM Transmitter

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Comprising of a top panel and tape mechanism coupled to a record/play back printed board assembly. Supplied as one complete unit for horizontal installation into cabinet or console of own choice. These units are brand new, ready built and tested.
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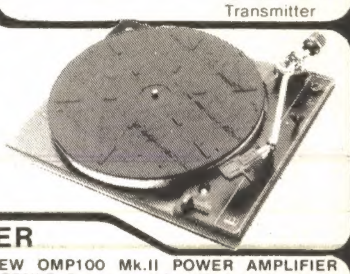

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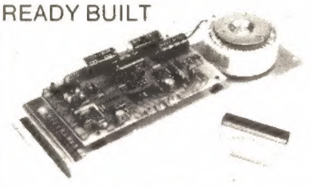

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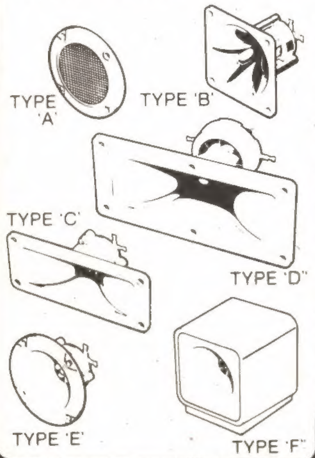

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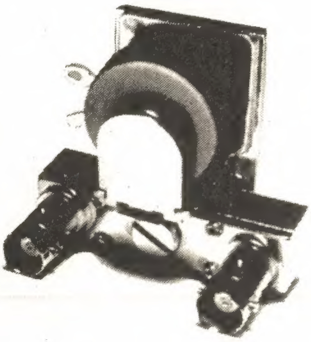
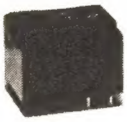


We must apologise to our readers for missing out with our Winter edition — but we've been preparing something a little special to tempt you out of your Winter hibernation and back to the soldering iron........



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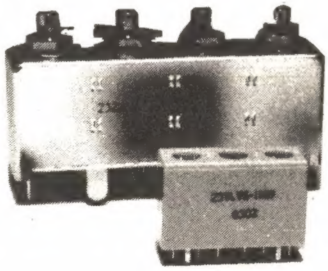

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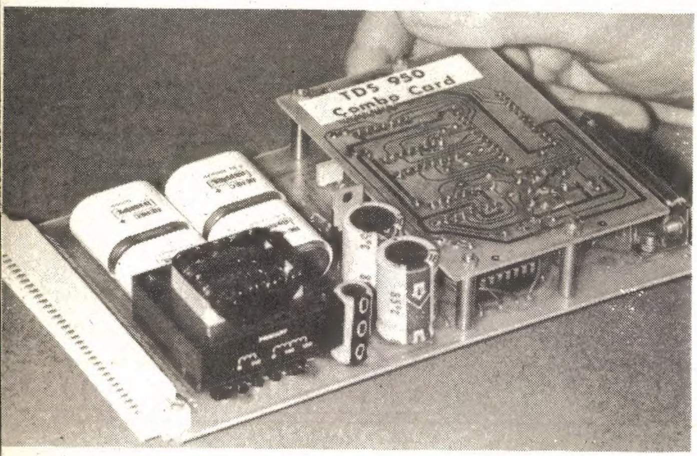
PRODUCT NEWS

Featured on these pages are details of the latest products in communications, electronics and computers. Manufacturers, distributors and dealers are invited to supply information on new products for inclusion in Product News
Readers, don't forget to mention ***Radio & Electronics World*** when making enquiries



COMBINATION CARD INTERFACE

The TDS950 Combo Card inserts in the RS232C line between a computer and a VDU terminal and it allows data to be put on a cassette at a data rate of 1200 bauds. Playback not only loads the data back into the computer, but also displays the content of the tape on the screen. It is single Eurocard size and can be used either with Triangle's own TDS900 FORTH computer card, or with other microcomputers.

Also included on the board s a mains power supply and 00 mAh of back-up battery.

Triangle Digital Services Ltd
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BENCH POWER SUPPLIES

A family of four high erformance bench power upplies, the GPL Series, has een introduced by Gresham owerdyne Ltd. Offering a hoice of single, dual and riple output models, they eature excellent voltage and urrent regulation, low ripple nd noise and compact echanical construction.

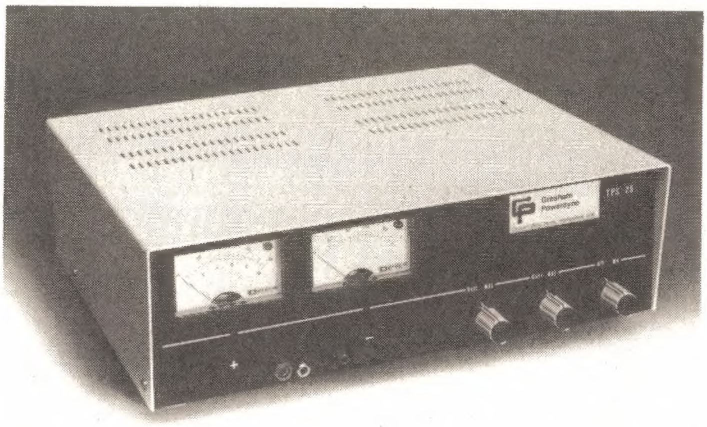
The smallest model is the PL 20, a light weight unit hich has a variable 0-30 volts (1 Amp max) output plus a fixed 5V output (1 Amp max). Ripple and noise is less than 0.5mV rms on both rails, and the variation in output voltage for a 10% mains variation is also less than 0.5mV. Output resistance is less than 5 milliohms and output impedance less than 100 ohms at 100 kHz. The GPL 23a triple output unit has two independently variable outputs each of 0.30V, (2 Amp max) with a choice of constant current or constant voltage modes. Additionally, a fixed 5V, 3Amp output rail provides regulated power for a substantial microcircuit load if required. Load regulation for the variable rails is better than 3mV (zero to full load), ripple and noise less than 1mV in constant voltage mode and line regulation is better than 0.5mV for a ± 10% mains change. For the fixed 5V rail, load regulation is better than 50mV (zero to full load) with ripple and noise less than 5mV rms.

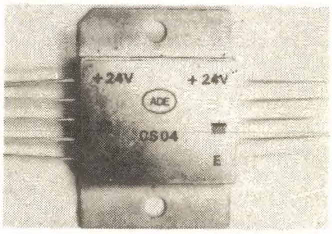
Setting resolutions are better than 5mV and metering is accurate to approximately 1% of full scale deflection.

The Model GPL 25 provides 0-40V up to 1 Amp and has variable current limiting. Two instruments provide simultaneous indication of voltage and current. The unit has 0.5mV max output regulation for a ± 10% mains change, ripple and noise less than 0.5mV rms and output resistance less than 5 milliohms.

The largest unit in the series (GPL 28), has a single 0-60V, 2 Amp output with dual tracking (0-30V, 2A) as standard facilities. It has the same high standard of regulation found on other units in the series.

Gresham Powerdyne Ltd.,
Osborne Way, Station Rd.,
Hook, Hampshire.





MEDIUM POWER AMPLIFIER

The CSO4 medium power integrated amplifier was developed for the French General Post Office and is featured in a range of new ADE products available from Nore Microwave Limited.

The amplifier operates over the frequency range 5 to 200 MHz and has a noise figure of 3 dB, gain 29 dB ± 1 dB and gain flatness within ± 1 dB. The output power is +24 dBm (250 mW) at 1 dB CP, input and output VSWR 1.5: 1 and the third order intercept point is +40 dBm. The characteristics are almost identical when the device is operated over an extended frequency range (3 to 300 MHz) and customized versions in respect of noise figure, bandwidth, gain and output power are available. The manufacturer guarantees compliance with the specification when the device is operated in the temperature range -25 to +85°C (using a heat sink adequate for 3W dissipation).

The amplifiers are housed in packages measuring 28.7mm x 20.2mm x 4.5mm overall (excluding leads) and have fixing centres 22.9mm apart.

Nore Microwave Ltd, 36
Towerfield Road,
Shoeburyness, Essex, SS3
9SH.

70 CMS ANTENNA

New from Ant Products, the Tiger LY9 for 70 cms.
A lightweight antenna with a heavyweight signal, it offers a high 11dB gain on a 58 inch

boom length. Great for vertical or horizontal mounting. The new antenna is supplied in matched pairs for the ultimate Oscar station complete with all hardware for mounting with elevation control. It is precisely adjustable for angle in order to get the best performance and also includes a matching unit for circular polarisation. Right or left hand can be chosen with equal efficiency.

Ant Products, All Saints Industrial Estate, Baghill Lane, Pontefract, W. Yorks.

ANALOGUE/DIGITAL MULTIMETERS

Three fully autoranging multimeters manufactured by Fluke are available from Electronic Brokers Ltd., all incorporating a fast analogue bar graph display as well as a 3½ digit display.

The basic model is the JF73 with 0.7% accuracy and the JF75 adds 0.5% accuracy, manual override of autoranging and audible continuity bleeper. The third model (JF77) offers 0.3% accuracy, with a carrying holster and unique touch-hold facility allowing the user to concentrate on positioning test leads without watching the display. The meter bleeps when it senses a stable reading and this reading is held until new test points are selected.

The series all measure dc voltage to 1000V, ac voltage to 750V, current to 10A and resistance to 32MΩ and have a single eight position switch for simplified function selections.

Electronic Brokers Limited,
61/65 Kings Cross Road,
London WC1X 9LN.

SPECTRUM MORSE TUTOR

A morse tutor for either the 16K or 48K. Sinclair Spectrum is available from Scarab Systems. The program offers the following facilities – adjustable speed; random letters/figures/mixed groups; adjustable group length; printout during or after the test, selectable number of groups; keyboard output section; adjustable tone. Messages can be stored and sent endlessly.

Scarab Systems, 39 Stafford St, Gillingham, Kent.

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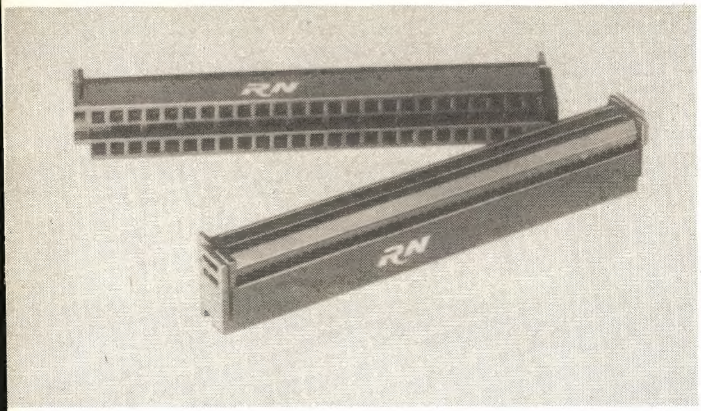
PRODUCT NEWS



BACKPLANE SOCKET CONNECTORS

A new series of backplane socket connectors that interface directly with .025in square backplane wrap pins on 0.1 x 2 in grids is announced by Robinson Nugent Ltd.

Known as IDB Series, they are available in 50-pin sizes and terminate to flat cable on a .050in pitch. Single piece construction lowers total assembly cost and stainless steel strain release is optional. Contacts may be in phosphor bronze or beryllium copper.

Robinson Nugent Ltd., 74
London Road, Riverhead,
Sevenoaks, Kent.

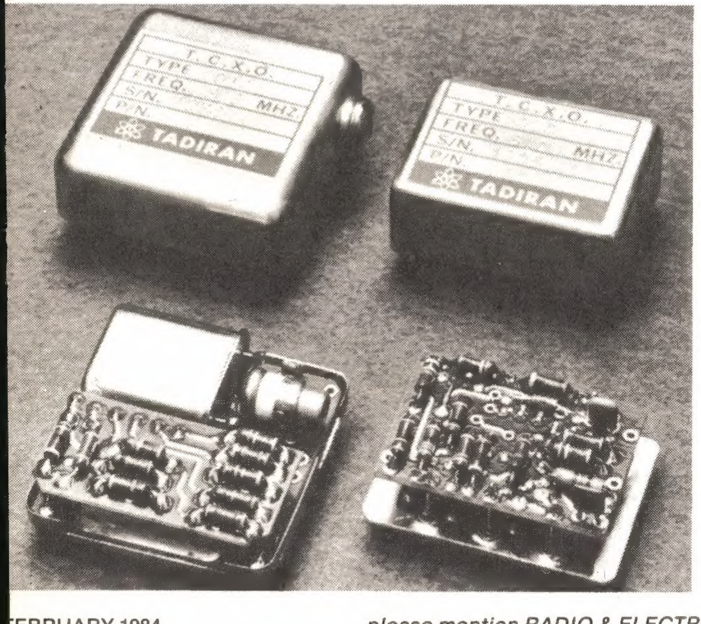
TEMPERATURE CONTROLLED CRYSTAL OSCILLATORS

The Steatite Group have now introduced the Tadiran range of temperature controlled crystal oscillators (TCXO) for professional and military applications.

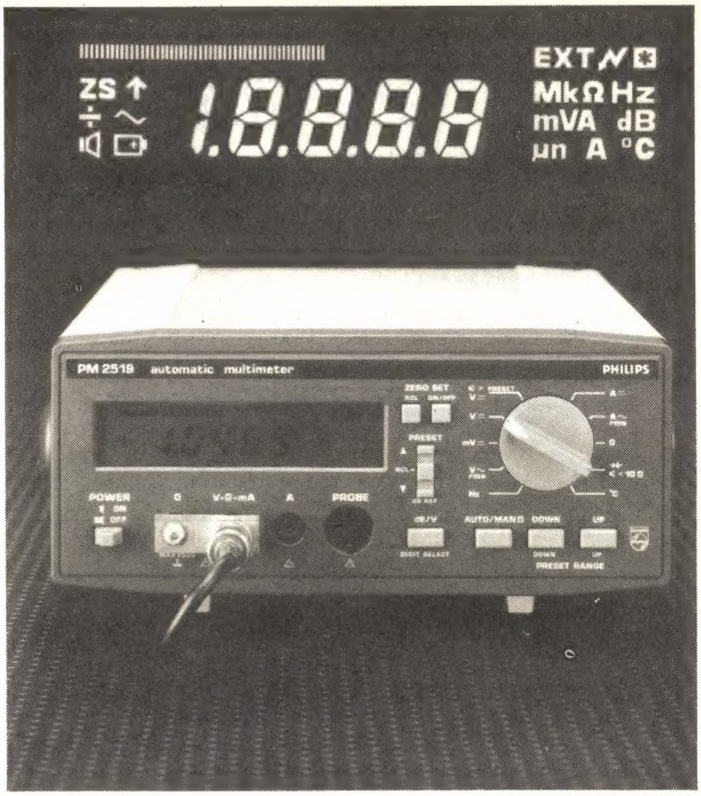
Tadiran specialise in high stability units, achieving 1ppm between -40°C and +85°C if required. Relaxed versions are also available but generally they are supplied to specifications such as MIL-Q-55310 or better.

The frequency range extends from a fraction of one hertz (using dividers) to 25MHz. Typical power consumption is 60mW but special versions are available for lower requirements.

Steatite Insulations Ltd.,
Hagley House, Hagley Road,
Birmingham B16 8QW.



NEW DIGITAL MEASUREMENT CENTRE



Philips new PM 2519 Digital Measurement Centre (DMC) is a complete multifunction instrument with power and versatility to solve more testing problems than any conventional digital multimeter (DMM) in its class.

This bench top/portable DMC includes a bar graph display for easier analogue circuit setting, electronic calibration via the front panel (or optional, low cost IEEE bus) and is fully auto-ranging for easier, more convenient operation. It has full V, I and R capabilities (10μV to 20A) with a basic 0.1% accuracy and an automatic counter function allowing frequency measurement up to 1 MHz via the same V, I, R input. DB may be measured on both AC and DC voltage ranges and there are 16 selectable reference values from 50 ohms to 8k ohms.

Relative reference measurements are possible on all ranges using the 'Dial-a-Reference' feature and non-volatile memory.

The instrument has a 50-point logarithmically scaled bar graph which indicates some digitally displayed values, providing a virtual analogue display which facilitates null adjustments. The bar graph can also be used in the relative reference mode enabling rapid and simple adjustment to be made to specific values, using the non-volatile memory.

The extended 4-digit LCD display includes a range of user information and warning symbols including clear messages that warn when it is being used beyond a specified range or when potentially dangerous voltages are being measured. An 'Error' message alerts the user attempting to make other measurements with the 10A input still connected, and other types of operating errors.

Range (as distinct from function) and relative offset are both programmable on the IEEE bus version. The PM 2519 can make more than four measurements a second and may be triggered via the bus or from a hand-held probe.

Self-test for correct functioning is provided and, in the event of a fault, the built-in signature analysis fault-finding technique permits fast detection and repair. A full overload protection circuit is provided.

Pye Unicam Ltd, York Street,
Cambridge CB1 2PX

DUAL TRACE OSCILLOSCOPE WITH COMPONENT COMPARATOR

Currently available from Electronic & Computer Workshop Ltd., is the new Crotech type 3132 20MHz dual trace oscilloscope. This has a 5in CRT and replaces the type 3131 dual trace oscilloscope. It features a 2mV/div calibrated sensitivity on both channels, algebraic addition and subtraction, a 40ns/div to 0.2s/div timebase, 14 trigger functions with triggering to

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The new IC-02E
Push-button Perfection

ICOM introduces the new top-of-the-line IC-02E to compliment its existing line of popular handheld transceivers and accessories. The new direct entry microprocessor controlled IC-02E is a 2 meter handheld jam packed with excellent features.

Some of these features include: scanning, 10 memories, duplex offset storage in memory & odd offsets also stored in memory. Internal Lithium battery backup and repeater tone are of course included.

Keyboard entry is made through the 16 button pad allowing easy access to frequencies, duplex, memories, memory scan and priority. The IC-02E has an easy to read custom LCD readout indicating frequency, memory channel, signal strength, transmitter output and scanning functions.

A battery lock, frequency lock and lamp on/off switch are also featured, as is an aluminium case-back, providing superior heat sinking.

A variety of batteries will be available for the IC-02E, including new long-life 8.4 volt and 13.2 volt packs. Charging may be done from a top panel connector for 13.8 volts which will also power transceiver operation. The IC-2E continues to be available, and its complete range of accessories work with the new IC-02E.

The IC-02E comes with the BP3 Nicad battery pack, BC25E wall charger, flexible antenna, wrist strap and belt clip as standard equipment. A truly excellent product destined to a great future.

We do not sell any sets until we know them inside out. A bold claim, but true. Our engineers have been trained by ICOM in Japan, and can guarantee the best after-sales maintenance service available.

As well as the 02E, 751, 745, 271, 471, R70, 290D, 490E, 25H, 45E, 2KL, AT100, AT500, 120, 2E, 4E in the ICOM range we also stock such famous names as Tono, Telereader, Cue Dee, Versatower, Yaesu, Jaybeam, Datong, Welz, G-Whip, Western TAL, Bearcat and RSGB Publications. Thanet Electronics can offer you the most comprehensive and thorough service.

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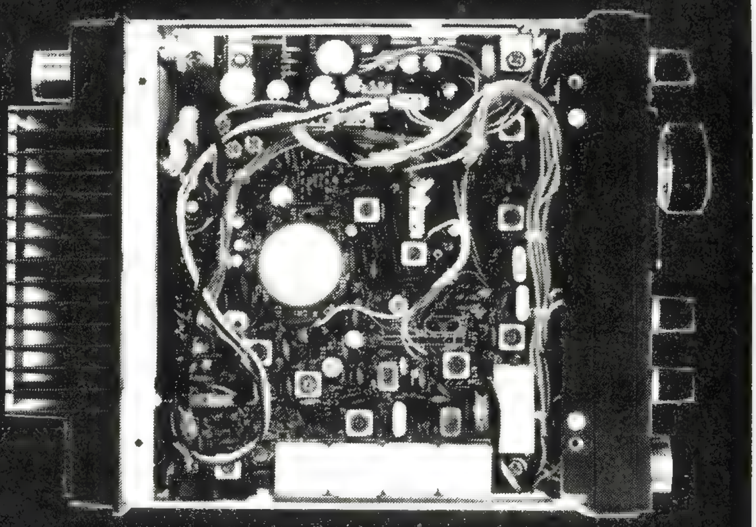

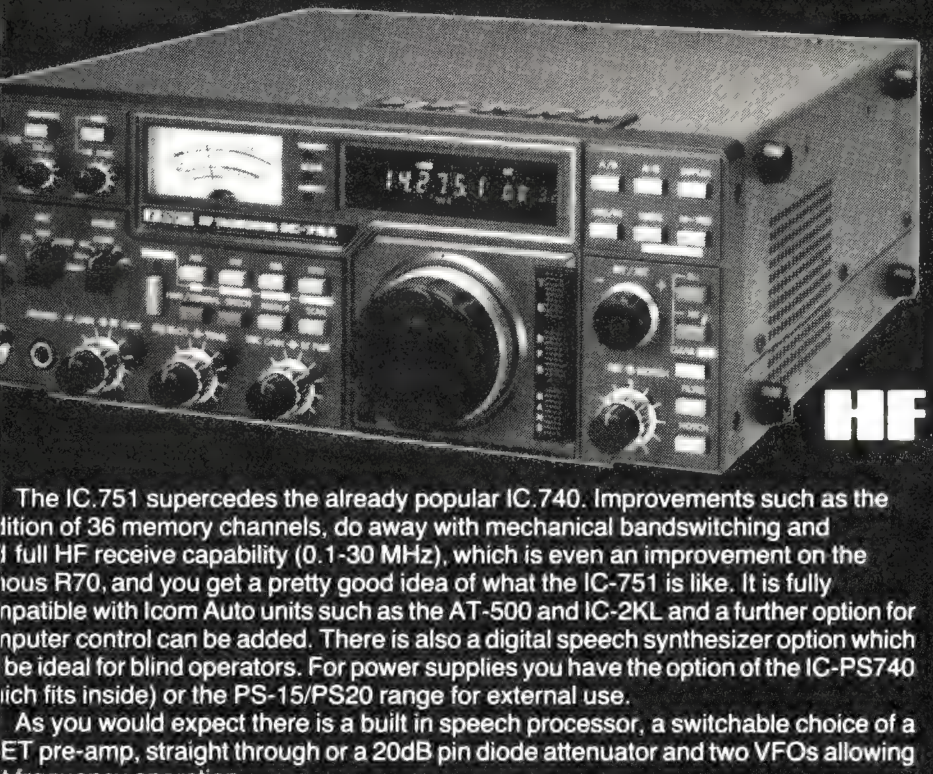

IC·751, £969.
HF Transceiver

The IC.751 supercedes the already popular IC.740. Improvements such as the
dition of 36 memory channels, do away with mechanical bandswitching and
d full HF receive capability (0.1-30 MHz), which is even an improvement on the
mous R70, and you get a pretty good idea of what the IC-751 is like. It is fully
npatible with Icom Auto units such as the AT-500 and IC-2KL and a further option for
nputer control can be added. There is also a digital speech synthesizer option which
be ideal for blind operators. For power supplies you have the option of the IC-PS740
ich fits inside) or the PS-15/PS20 range for external use.

As you would expect there is a built in speech processor, a switchable choice of a
ET pre-amp, straight through or a 20dB pin diode attenuator and two VFOs allowing
t frequency operation.
her standard features include:- 36 memory channels with scan facility and start/stop
ers, a marker, 4 variable tuning rates, Pass Band Tuning, notch, variable noise
nker, monitor switch, DFM (direct feed mixer) in the front end, full break-in on CW
d AMTOR compatibility. The first IF is 70.045 MHz. Any XIT and RIT adjustment is
own on the display. The transmitter features high reliability 2SC2904 transistors in
w IMD (-32dB@100W) full 100% duty cycle. Power is restricted to 40W on AM and
ustable from 10W on all modes. FM and the IC-FL44A crystal SSB filter are both
ed as standard.

As you can see from this brief description the IC-751 is certainly a transceiver
rth considering – Why not call us for further details?

Agent Please telephone first, anytime between 0900 – 2200 hrs.
Gordon G3LEQ Tel: Knutsford (0565) 4040

All prices shown include VAT.
Interest-free credit available
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General Manager, Electronic & Computer Workshop Ltd.,
171 Broomfield Road,
Chelmsford, Essex. CM1 1RY

HIGH SPEED STATIC RAM

The Semiconductor Division of Toshiba (UK) Limited has introduced a 16K bit static random access memory (SRAM) with fast access time and a very low active and stand-by current specification.

Organised at 2048 words by 8 bits and operating from a single 5V supply, the Toshiba TMM 2016 AP-90 features a maximum access time of 90ns and a maximum operating current of 80mA. A power down feature places the device in a low power standby mode in which the maximum current is 7mA.

This high performance speed and power combination makes the new TMM 2016AP-90 ideally suited for use in microcomputer peripheral memory where low power applications are required. Another technology requiring access times below 100ns is high speed video applications. The MOS SRAM features directly TTL compatible inputs and outputs and output buffer control.

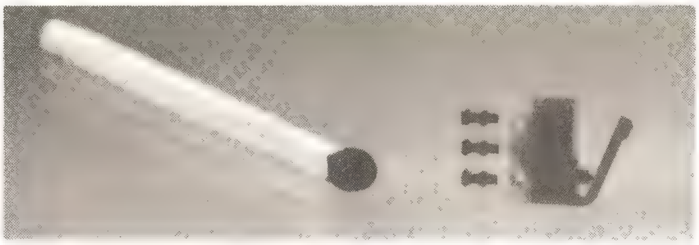
The TMM 2016AP-90 is fabricated with ion-implanted N channel silicon gate MOS technology, a key factor in providing the performance and reliability. It is supplied in a 24 pin plastic 0.6in package.

Toshiba (UK) Ltd., Toshiba House, Frimley Road, Frimley, Camberley, Surrey. GU16 5JJ.

NEW PERSONAL COMPUTER

The Hitachi MB 16001 has a built-in 16 bit microprocessor and expandable address space allowing memory capacities up to 384k. The high resolution colour can display up to 2000 characters in 15 different colours while a video RAM provides 640 dot (horizontal) x 400 dot (vertical) graphic resolutions in eight different colours. Twin 320K mini floppy disk drives are built in to the main frame with provision for extra 5¼in or 8in drives if required. The keyboard is independent of the mainframe which contributes to more convenient operation. The MB 16001 can accept programs written in BASIC or more sophisticated programs in FORTRAN, COBOL or PASCAL.

GSL Computing, 2 North Way, Andover, Hampshire. SP10 5AZ.



MINIATURE MICROSWITCH

An ultra miniature 50-volt microswitch with actuator arm is announced by Semiconductor Supplies International, Sutton.

This 300 MA single pole changeover switch weighs 0.3 grams. The dimensions are:- height (inclusive of pins and with lever compressed) 10mm, width 8mm, thickness 3mm.

The actuating lever of this switch is shaped for cam follower applications as well as for ordinary compression applications.

Other possible uses include the tamper proofing or safety switching of small equipment including security equipment such as sensors and for switching scale models and, indeed, in any other miniaturised equipment.

Semiconductor Supplies International Ltd,
128/130 Carshalton Road,
Sutton, Surrey.
SM1 4RS.

GIGAHERTZ FREQUENCY COUNTER

A new low-cost gigahertz frequency counter, the Model 6002, has been launched by GSC which measures frequency from 5HZ to 1GHz and also offers period measurement from $1\mu s$ to 200ms.

A 10MHz crystal-oven oscillator timebase ensures a stability of within ±0.5 parts in 10^6 from 10°C to 40°C and a variation of less than one part in 10^6 per year.

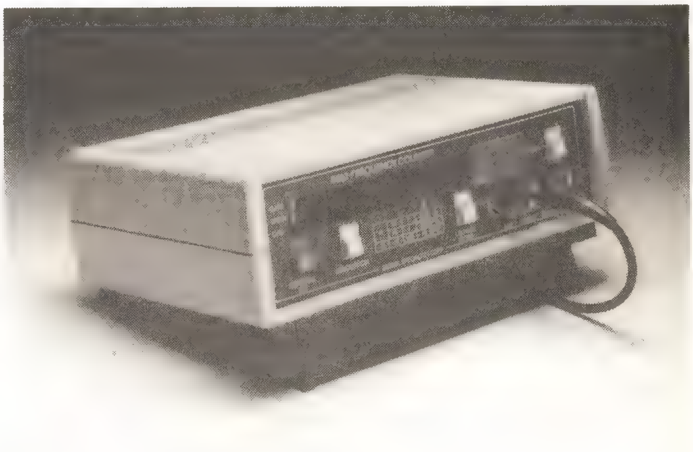
Designed for ease of operation, with touch-button controls and a large, bright, 8½-digit LED display, three different resolutions can be selected via front-panel buttons and a switchable low-pass filter provides a 6dB/octave roll-off at 60kHz to facilitate audio and ultrasonic measurements.

Two front-panel AC-coupled input connectors provide a high degree of measurement flexibility. The 'A' input, incorporating a low-pass filter, accepts signals from 5Hz to 100MHz with an in put impedance of 1 megohm at 20pF, resolutions of 10Hz, 1Hz and 0.1Hz, and a x100 multiplication mode for speeding lower-frequency measurements. The 'B' input accepts signals from 80MHz to 1GHz with an input impedance of 50Ω at 10pF and resolutions of 1kHz, 100Hz and 10Hz.

The instrument has leading-zero blanking, a contrast-enhancement filter for bright-light viewing, LED lamps for gate-open, oven-ready and overflow indication and a flip-up leg for benchtop use.

It is equally suited to audio or VHF measurements in communications, data processing, process control, radio-frequency design, digital design, quality control and maintenance.

Global Specialties Corporation, Shire Hill Industrial Estate, Saffron Walden, Essex. CB11 3AQ.



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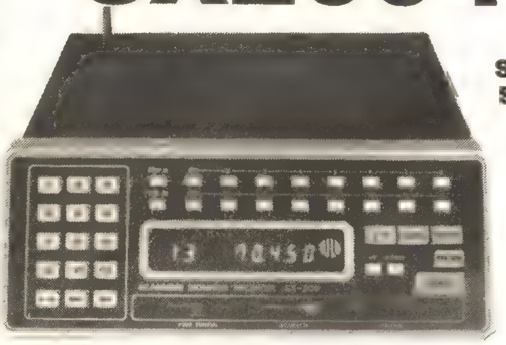

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PRODUCT NEWS

PORTABLE PROJECTION COLOUR TV

Matsushita has recently announced the availability of 'the world's first 6.5-inch screen portable rear-projection colour TV' (shown here). This weighs only 3kg (about half the weight of conventional 7-inch screen TVs) and is collapsable, folding down into an attache case 25cm x 8.5cm x 31cm.

The technology used is the same as that of Matsushita's large screen projection TV systems, with three 5-cm projection tubes – one for red, green and blue – performing the role played by the CRT of a conventional TV.

In addition to receiving regular broadcast programmes, the new projection TV (which consumes only 12W) can be used as portable display terminal for teletext, viewdata and other video information services.

There are no plans at present to introduce it into the UK but further information about this TV can be obtained from National Panasonic.

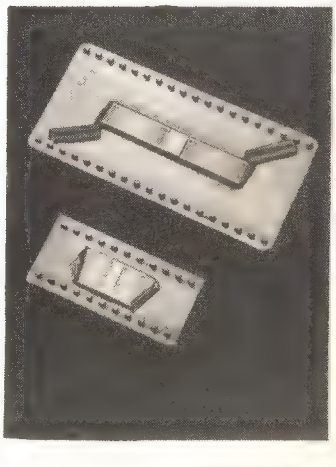
National Panasonic (UK) Ltd,
300-318 Bath Road, Slough,
Berks S11 6JB

SAW FILTERS

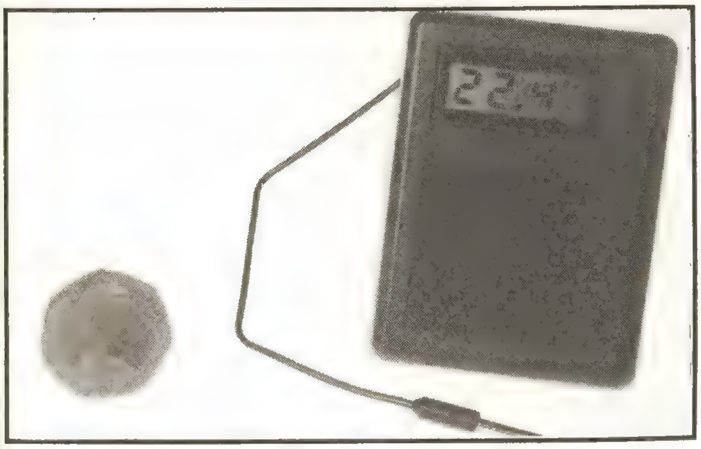
Tadiran, which already has an extensive range of products for broadband communications applications (for example, chirp expanders/compressors, delay lines, MSK generators and fast frequency synthesisers), has now introduced a new SAW filter that is constructed using hybrid thin film technology. The new device is a 32-bit electronically programmed PSK matched filter, consisting of a SAW tapped delay line, CMOS switches and control logic which determines their positions. It operates at IF with a carrier frequency of 70MHz: the taps correspond to a bit length of 200μsec (5Mbit/sec).

The device is being marketed in the UK by the Steatite Group.

Steatite Insulations Ltd,
Hagley House, Hagley Road,
Birmingham B16 8QW (Tel:
021-454 6961)



PRODUCT NEWS



MULTI-PURPOSE THERMOMETER

Electronic Temperature Instruments has introduced a new electronic multi-purpose thermometer with some distinct advantages over any glass instrument and indeed the majority of its competitors. Not only is it reasonably compact (82mm x 63mm x 23mm) but it also features an easy-to-read liquid crystal display, long battery life and a waterproof, non-corroding sensor. The thermometer measures temperatures within the range 0–99°C with an accuracy of 0.1°C. Its usefulness is further enhanced through its ABS case incorporating a built-in wall mounting bracket and a table-top stand.

The Thermotron is believed to be particularly well suited to the measurement of air, liquid and semi-solid temperatures in such areas of industry as process and production, plant maintenance, heating and ventilation, health and safety – as well as generally in the laboratory.

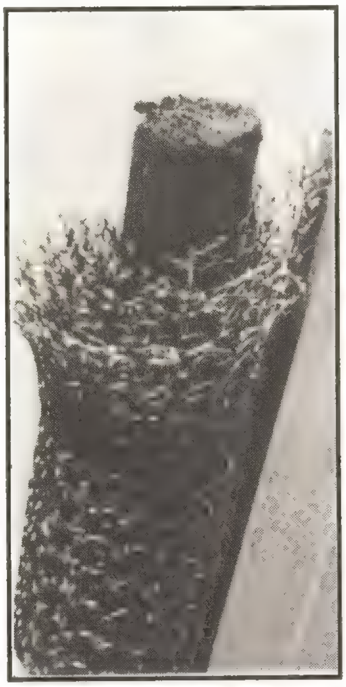
Electronic Temperature Instruments, Highdown Avenue, Worthing, Sussex (Tel: Worthing 692161)

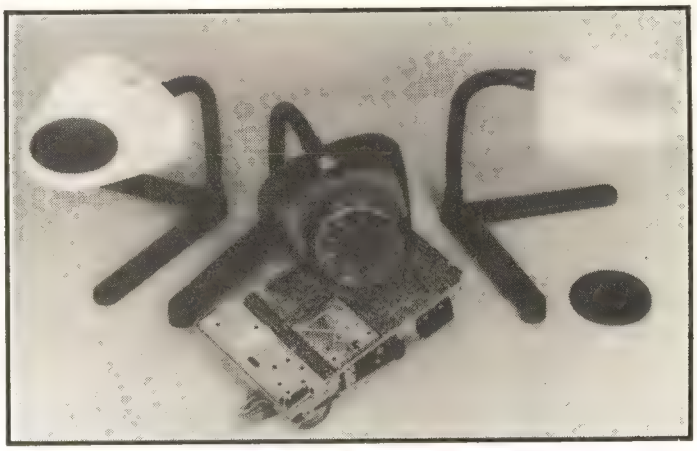
RIGID RFI GASKET

Extrudashield is a new composite RF interference gasket material from RFI Shielding. The material, which comprises strips of knitted wire mesh (or a combination of a mesh and an elastomer), all retained within an aluminium extrusion (see picture herewith). It provides up to 110dB at 10MHz and is supplied in individual strips up to 4m long and 3.18–15.9mm wide. Alternatively it can be supplied welded into punched or drilled frames and based on a wide variety of metal extrusions, depending on the needs of the specific application.

One of the advantages of Extrudashield is that the metal extrusion can be attached to enclosure flanges and covers, thus eliminating the problems associated with loose gaskets. The extrusion additionally acts as a compression stop for the mesh, preventing it from being compacted, though the latter is knitted from Monel wire which is capable of withstanding a high compressive force. For lower compression joints, either sponge, solid silicone or neoprene elastomer is combined with the mesh.

RFI Shielding Ltd, Warner Drive, Springwood Industrial Estate, Rayne Road, Braintree, Essex CM7 7YW (Tel: Braintree 42626)





BENCH MAGNIFYING LIGHT

Tally Ho Lighting has introduced a magnifying lens incorporating a lamp, which has been designed to assist small intricate work in the laboratory. It should therefore be of benefit to both the individual constructor and those working in many electronics engineering plants.

The unit is moulded in a tough plastic has a twin-arm base and a flexible coil arm. The lamp section incorporates a magnifying lens and a 40W bulb. The lens accentuates the light to produce good illumination while magnifying the object of interest at the same time.

Tally Ho Lighting Company, 10 Pennine Parade, Pennine Drive, London NW2 1NT (Tel: 01-445 5060)

BARRIER LAYER CAPACITORS

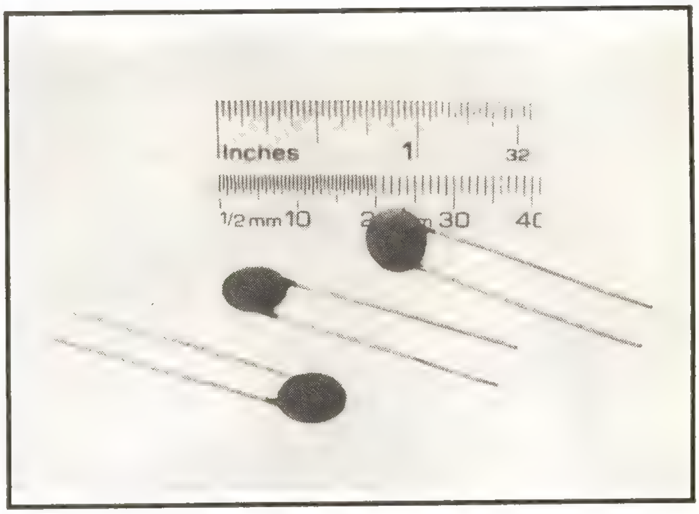
Murata Erie have extended their range of barrier layer capacitors with the introduction of new components which are both physically small and inexpensive.

The new capacitors are surface layer types featuring high reliability and low temperature coefficients, the capacitance varying by less than ±15% over the temperature range -25°C to +85°C.

This range was developed primarily for coupling and decoupling applications and includes 16V, 25V and 50V rated components with preferred capacitance values from 0.01 to 0.1 microfarads, all the devices being available on tape for auto insertion if preferred.

The low cost DD 308 style incorporates new 'F' characteristic ceramic material which provides 0.1 nF capacitance at 25V in a disc of only 8mm diameter. The temperature coefficient is +30% to 80% over the temperature range – 25°C to +85°C which ensures the component is suitable for decoupling applications.

Murata Erie Electronics UK Ltd, 104 Albert Street, Fleet, Hampshire GU13 9RN (Tel: 02514 21247)



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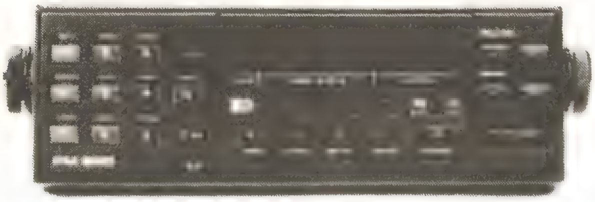


INTELLIGENT TWO-WAY RADIOS

Pye's FM900 and MX290 nobile radios are seen as epresenting a new eneration in advanced two-vay radios. Their solid state ircuitry has been developed o handle data transmission nd telemetry, as well as peech, with a high degree of eliability and minimal naintenance down time.

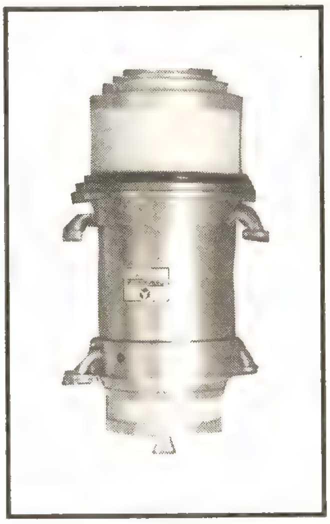
The FM900 (pictured here) s a frequency-synthesised levice that incorporates a arge-capacity' nicrocomputer and has been lesigned to offer a number of ophisticated software ptions without increasing its perational complexity. Aembers of the MX290 series lso incorporate frequency synthesisers, offering up to 250 channels accessible from either a conventional control or a key pad, and they have been designed on a modular basis to allow users to tailor the system features to their requirements.

The important aspect of these radios is the way they have been designed specially for such users as bus operators to whom the collection and display of fast, regular management control information is of benefit. Thus the FM900 is able through its software to interface with vehicle location and monitoring systems, whilst obtaining information like how full the bus is and whether it is on schedule via a 'handshake' with an equivalent device in the electronic ticket-issuing machine over a standard datalink.

Pye Telecommunications Ltd,
St Andrews Road, Cambridge.
CB4 1DW

1MW+ TETRODE

The TH539 tetrode from Thomson-CSF shown here can deliver up to 1.2MW of RF carrier power at up to 2MHz or up to 4MW CW output power at frequencies as high as 50MHz. The device, which is described as being 'at the summit of the electron-tube art', incorporates 'Pyrobloc' pyrolytic-graphite grids which are expected to give it very high stability, reliability and a long operational life. At the same time, its 'Hypervapotron' water circulation system allows up to 1MW to be dissipated on the anode with a wide margin of safety with respect to overload.



Combined with TH558 tetrodes (which use the same technology), the TH539 is expected to form the basis for compact 'superpower' MW or LW radio transmitters that operate with higher electrical efficiency and greater reliability than their counterparts.

Thomson-CSF Components and Materials Ltd, Ringway House, Bell Road,
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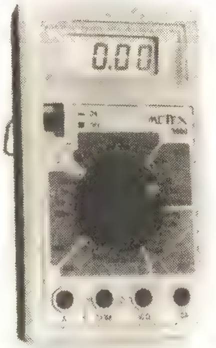

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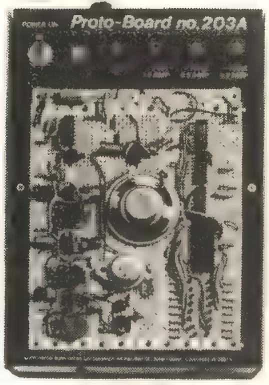

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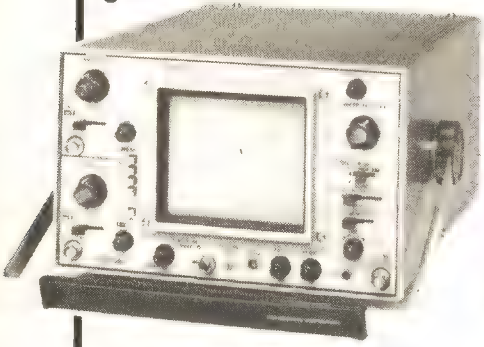

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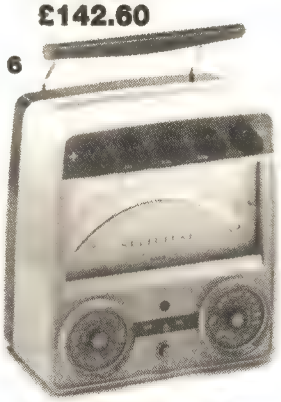

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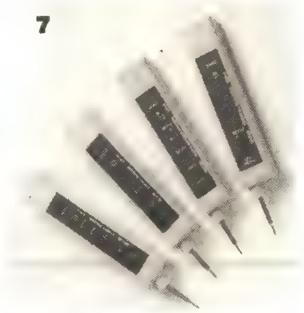

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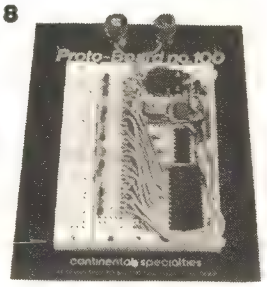

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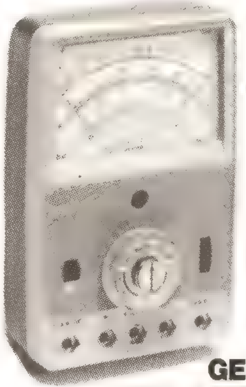

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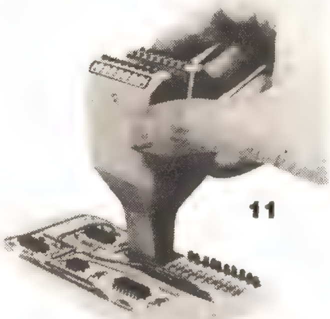

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NEWS

Columbia to Jordan

Astronaut Owen Garriott, who had fitted his amateur radio equipment in the European Spacelab, made an unusual contact whilst orbiting in the space-shuttle 'Columbia' recently.

Having passed over the Gulf of Aqaba, he made contact with King Hussein of Jordan who was very excited about his first direct contact with a fellow-amateur in the shuttle.

At a height of 155 miles above ground, the whole of Jordanian territory was in view and the astronaut was able to provide the ruler with his first extra-terrestrial description of his Kingdom.

Amateur radio transmissions from Grenada during US intervention

An American student, Mark Baratella, assisted by other operators provided the only reports that were available to the press when US forces landed in Grenada during October 1983.

The press reporters were prohibited from accompanying US Marines during landings and depended on the amateur radio experience of Mark who operated from the Grand Anse campus of Saint George's Medical School, providing up-to-the-minute accounts of the situation.

We understand that US radio amateurs, Bob Cunningham and Tim Daniel, contacted Mark and have written a comprehensive account of the events which began on October 25th, 1983. This account has been published by '73 Magazine'.

A plea for planning

John Carlton, Chairman of the Mobile Radio Group of ECREEA (the European Conference of Radio and Electronic Equipment Associations), made a call at a recent convention on land mobile radio services for long-term frequency planning. He asked 'Can we not agree internationally a long term aim to set aside frequencies between 30MHz and 1000MHz for mobile applications only, where radio is the proper – indeed the only possible – tool to give us communication.' The reason that it would have to be a long term aim is, of course, that these frequencies are currently occupied by other services – so the process of change will probably take twenty years or more.

His argument is that mobile communications requires use of the radio spectrum, while these other services could change to wire or optical cables. Moreover, if these changes weren't made, we would be restricting ourselves and not providing the sort of freedom to communicate that not only enhances the quality of life but can save lives.

Mr Carlton also feels that, in this communications age, the public should be made aware of the facilities that new technology brings. 'We must become more skilled in new technologies like cellular radio, LSI/VLSI, switching and system software, satellite systems, spectrum utilisation techniques and voice storage and retrieval.

FORTHCOMING EVENTS

A two metre FM contest

This contest will be held on Sunday 15th April 1984 between 1300 and 1700 GMT in the 144.5-144.845MHz and 145.2-145.475MHz sections of the band.

It is open to members and non-members of the Stevenage and District Amateur Radio Society and there will be three classes of entry as follows:-

1. Stations operating up to 25 watts output.
2. Stations operating more than 25 watts output.
3. Short wave listeners.

For further information, please write (enclosing a stamped, addressed envelope) to:- *The Contest Secretary, Bernard Dean G6NZC, 82 Lingfield Road, Stevenage, Herts, SG1 5SN.*

WARNING TO USERS OF FT290R EQUIPMENT

Norman Bedford (G4NJP) has drawn our attention to a potential hazard concerning use of FT290R equipment and we suggest that immediate action is necessary to avoid possible serious damage to equipment and the surrounding area.

Norman was using the FT290R as a mobile setup and made an emergency stop when his car filled with smoke from the equipment. Upon investigation, he discovered that the positive battery lead was trapped between the case of the battery holder and an earthing post thereby short-circuiting the fully charged Nicad batteries.

After clearing the fault and removing the debris, he found that the 290 worked as well as normal. He has since heard of three other sets that have suffered short-circuited batteries for the same reason, thus it seems that a particular degree of care should be exercised when fitting the batteries. Further, other owners have mentioned that another problem is associated with the Nicad battery pack area of the equipment, ie, the external power connector socket does not disconnect the Nicads when the external supply is connected.

Apart from these problems, Norman seems to be well-satisfied with his equipment.

For beginners

A beginners' course in Morse Code will commence at Brooklands Technical College, Weybridge, Surrey, on Thursday 9th February. The class will run for ten weeks and will meet on Thursdays from 6.30pm to 8.00pm. Enrolment will take place at the college on Thursday 2nd February from 6.30pm to 7.00pm. For further details contact Chris Roberts at the *Dept of Technology, Brooklands Technical College, on Weybridge 53300 extension 246.*

Company News

Distributor

Hawke Electronics Ltd., has been appointed a franchised distributor for *Virtual Microsystems Limited.* Established to market throughout Europe the products of its American parent, Virtual Microsystems Inc., the new UK company will eventually supply and support a range of hardware and software products which enable non-DEC operating systems to be run on DEC mini-computers. The first product to be made available allows the established operating system CP/M from Digital Research to run on all DEC mini- and microcomputers from the VAX downwards. This includes the PDP-11/LSI-11 series.

British Telecom signs

British Telecom has signed an agreement with a major television programme provider to distribute programmes to local cable networks by satellite. The agreement, with *United Cable Programmes* – a consortium which includes Rediffusion, Plessey, Rank Satellite and Cable, UIP Pay TV and Visionhire Cable – is a breakthrough for British Telecom, which will soon be distributing new programmes to hundreds of thousands of cabled homes throughout the UK. The service, which has already been demonstrated to programme providers and cable operators, will begin on March 1, 1984, and British Telecom will transmit programmes via the Intelsat V satellite to cable head-ends equipped with small satellite dish aerials. Sir George Jefferson, Chairman of British Telecom said: 'The cabling of Britain provides one of the major opportunities for business growth in the UK and BT is determined to play a major role in this.' Mr. Nicholas Mellersh, Chief Executive of UCP, said: 'In British Telecom, we know we have the best possible partner for our new venture. From March 1 next year UCP will be supplying Rediffusion, Visionhire, Greenwich Cablevision, as well as an existing cable operator with

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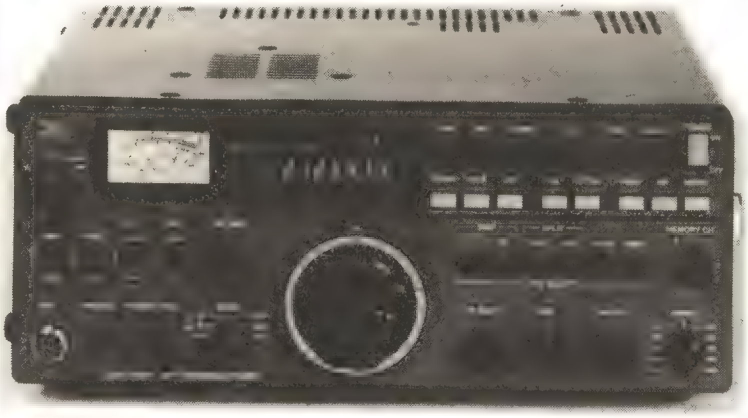

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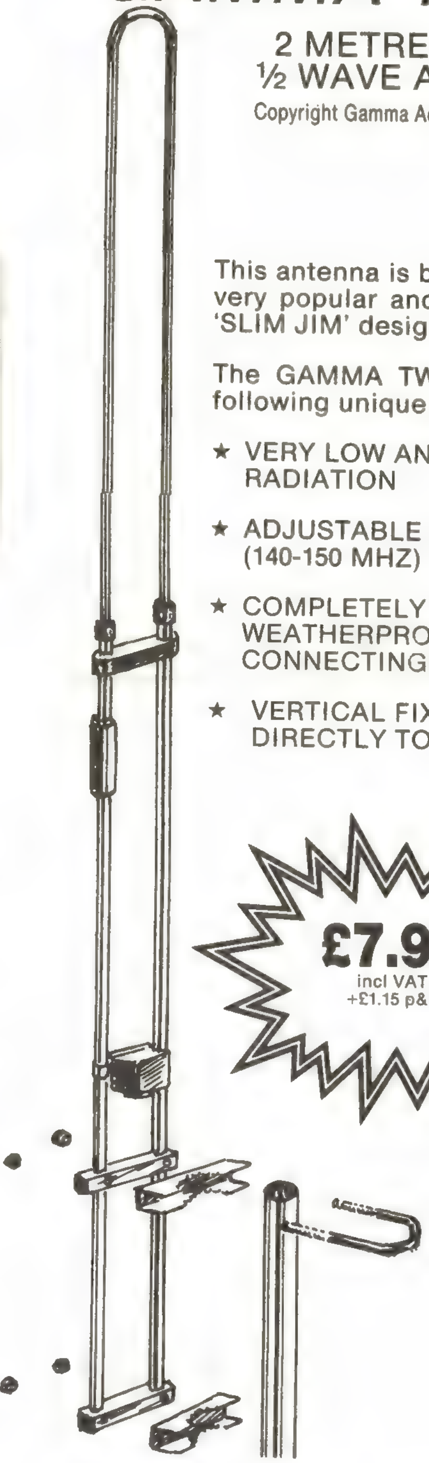

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Instant finance available subject to status
Written details on request

NEWS

EN, The Entertainment etwork.' British Telecom is ow engaged in negotiations ffering other programme roviders extra TV channels y satellite. These additional V programmes can also be ccessed by cable head-ends sing the same receiving ishes necessary for the UCP roject.

British Telecom is also ffering to lease television eceive only (TVRO) erminals to cable operators or use at their head-ends.

CB's for EEC

Supplying printed circuit oards to the majority of EEC ountries, *N.V. Kling* have ow appointed *C.R. nternational* to be their xclusive agents in the UK. he company produce single ide, double side and through ole plated boards and arious types of materials can e provided. Finishes include oller and electrolytic tinning, old plating including various ypes of printing and rotective masking.

lessey chairman

Mr F K Chorley has been appointed Executive Chairman of *Plessey Telecommunications and Office Systems Limited (PTOSL)* with immediate effect. He is also appointed a Deputy Chief Executive of *The Plessey Company* and therefore a member of the Chief Executive Office. Mr Chorley, who has been with The Plessey Company since 1974, moves to PTOSL from Plessey Electronic Systems Limited (PESL), where he has been Deputy Chairman and Managing Director. At the same time Mr Eric Clark has been appointed Managing Director of *PTOSL*, reporting to Mr Chorley, with responsibility for both UK and US operations. Mr Clark was Chief Executive of Plessey Telecommunications Limited, a subsidiary of PTOSL.

London move

Industrial Science Ltd are moving their Dover based operation to new and larger premises in South West London. The new location is 18, The Osiers Estate, Osiers Road, London SW18 1NL.

The move will enable the company to greatly increase its stockholding in addition to offering an even better distribution and delivery network.

£50,000 order

Crow of Reading Ltd. has received an order worth £50,000 from *Robert Bosch GmbH, Darmstadt, West Germany*, for automatic video signal linear-distortion correction instrumentation. The units to be supplied are Model ACG 2037 Automatic Video Equalizers, (AVE), a type specially designed and manufactured to meet a stringent EBU specification. A significant number are in service in PTT switching centres which terminate video signal links, and form a standard part of the Eurovision picture quality control system.

The Independent Battery Specialists Association

The Independent Battery Specialist Association (known as IBSA) has been formed to act as an effective monitoring body dedicated to the upholding of established standards in the installation, operation and maintenance of secondary battery systems. The new association intends to provide assurance to contractors, specifiers, end users and others that member companies can be relied upon to meet the stringent demands imposed by both legislation and systems manufacturers.

A steering committee comprising the four founder member companies has been established, these four companies being:

Ensura Systems Limited of Rossendale Road Industrial Estate, Burnley, Lancashire, telephone (0282) 29261/2/3.

Telavex Limited of 1a Church Road, Epsom, Surrey, telephone (03727) 22911.

Computer Battery Services Limited of Aysgarth, Wedmore, Somerset, telephone (0934) 712147.

Sterling Safety Systems of 8 Station Road, Kenilworth, Warwickshire, telephone (0926) 58241.

General Secretary of the association is Mr J.M. Snowdon, at IBSA, 60 Waterloo Road, Wolverhampton, West Midlands, WV1 4QQ. Advice and assistance on any problems associated with standby power systems can be obtained by contacting Mr Snowdon or any of the four founder member companies. Enquiries regarding membership should be directed to Mr Snowdon.

Further information from: Adfield-Harvey Public Relations, PO Box 161, Grassy Lane, Wolverhampton WV10 8PS. Telephone (0902) 20702.

Marconi places satellite antenna contract

Ottawa, Canada. Under the terms of a £1.3M contract awarded here today by Marconi Space & Defence Systems Limited, an Ottawa-based company, Canadian Astronautics Limited, is to finalise the design, build and deliver an advanced communications antenna for the Skynet 4 military communications satellite for which British Aerospace is prime contractor.

As lead communications contractors to British Aerospace on the Skynet 4 programme, MSDS has designed a powerful UHF/SHF/EHF payload for the two satellites that will provide ships of the Royal Navy and land forces of the British Army with secure, highly efficient and flexible voice, data and telex links from 1985 onwards.

The UHF antenna to be supplied by CAL as part of the payload has been selected on the basis of its compact size (for launching purposes), its ability, when deployed, to handle the satellite's high output power and its highly innovative design.

Prestige contract

British Telecom is to supply the new telecommunications system for the Imperial College of Science and Technology.

The contract involves the installation of an SL-1 digital exchange and a BTS 123 communications management system from British Telecom National Networks.

Researchers at the Imperial College, one of Britain's premier high technology institutions, chose the SL-1 and BTS 123 combination because of the extensive and continuing development of these products.

The system has been designed to take full account of past and future compatibility. It can operate with both the ISDN (Integrated Subscriber Digital Network) and the new System X public telephone exchanges. This advanced private telecommunications switching system is compatible with existing public exchanges, PBXs and conventional telephones.

The SL-1, manufactured in the UK by GEC, is computer-controlled. The features and services are defined by a software program instead of wiring circuits. Capabilities can be modified, added to or deleted by altering the software rather than the hardware, allowing much greater flexibility.

More than 100 features and services are available from SL-1's advanced technology. These range from direct inward dialling ('DID') – allowing incoming calls to reach specific extensions without operator assistance – to six-party conferencing, and all forwarding. Other capabilities include 'splitting', which enables the operator to consult privately with either the source or destination party on a call. Access to paging equipment is available too.

No preventive maintenance is required on the SL-1. Fault detection gear is built in, enabling the system to check itself. A diagnostic printout is provided automatically should a fault occur, allowing rapid remedial action.

The SL-1 works equally well in small businesses needing 100 extensions as for larger organisations with several thousand extensions.

The SL-1 digital exchange provides additional facility in that no preventative maintenance is required because comprehensive fault-detection equipment is built in enabling the system to self-check its operation.

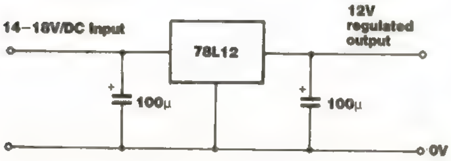
QUESTIONS & ANSWERS

Do you have any technical or practical questions that you would like an expert answer to? A selection of readers' questions will be answered each month on this page. We regret that we cannot enter into individual correspondence with readers

Write to Q & A, ***Radio & Electronics World,*** Sovereign House, Brentwood, Essex, CM14 4SE

Ronald Bray **, who is making a crystal calibrator (Aug 1983 issue), says he would like confirmation of the voltage to be supplied.**

The crystal calibrator, being a CMOS device, will work from any voltage from 5 to 15 volts, but for reliable regulation the supply should be regulated. An example is shown below:-



Harry Grant asks, **'Is it possible for you to let me have the address of Leader Electronics as I am interested in one of their test units.'**

Information concerning Leader equipment is available from the sole UK importers:- Thandor Electronics Ltd., London Road, St. Ives, Huntingdon, PE17 4HJ.

With reference to the project 'ac Control Data Brief on the VAL CSR Range' (April 1983), could you please advise a list of stockists, addresses and general guide to price. *Peter Deacon.*

The VAL CSR 1504A and 1504B are available from Ambit International, 200 North Service Road, Brentwood, Essex. CM14 4SG. Telephone (0277) 230909. Their stock Nos 61-01504 and 61-01514 cost £8.43 plus VAT and 60p postage.

TG Mitcherall **wishes to find a reference for world-wide stations and operating frequencies for SWL.**

We are advised that a comprehensive list is published in 'World Radio & TV Handbook', available from Billboard Ltd, 7 Carnaby St, London, W1V 1TG. This is an annual publication, fairly expensive and contains information additional to that required. We suggest you try the local reference library first to see if a copy is available there.

The subject of my enquiry is 'Communication Building Blocks', Part 1 (Oct 1983) and various Data Briefs.

I have been planning a project using IC's based on Data Briefs but have had difficulty in selecting some of the other components (for the 'Communications Building Blocks' circuit, Figure 2 in Oct 83 issue), e.g. transformers and filter.

The filter F1 will have to be 10M15A with input/output impedance of 3K. This leaves the requirement to know what is used for T2, T3 and, also, what is used in the T4 position to match into KB4413 and match a diode detector/agc circuit.

I note that the PCB's in the article differ from those in the Data Briefs, does this mean that project packs will be available for these and will the Data Brief PCB's still be available.

The project I have in mind is a simple 160m AM receiver that can be further developed into a TX/RX with single knob tuning. *J F Perry, G4FJP.*

The transformer you want for T2 is a KACS3894A (35-38940), and T3 is a YHCS-1A590R (35-05900).

The output coupling IF (T4) can be the same as T3 – although a YLE4A888EK presents a lower primary impedance – which can help if the circuit is prone to instability. Both should work with a diode detector – and don't forget the AGC is positive-going to reduce gain.

The rest of your proposed circuit is very interesting – my only observation being that if you chose oscillator high, then there are a couple of modules and ICs capable of giving you a DFM readout.

You could of course use NBFM instead of AM: the advantages are many, and disadvantages few. I'm rather keen to try and see if we can encourage an NBFM movement for 160/80/40 since this could solve a lot of TVI problems, as well as provide a very cheap and strain-free local communication medium.

As far as continued availability of the data brief PCB and project packs is concerned they may not be available for a couple of months. These boards will be superseding the databrief PCBs in due course anyway, since I hope we can maintain a reasonably standard set of dimensions.

The planned range of building block options is fairly well established – although the order of appearance will be decided by circumstances, requests and (hopefully) readers' own submissions. I hope that you will bear this in mind when pursuing your project.

I have a SONY ICF 2001 radio (illustrated in December 83 issue) and ge excellent reception on BBC programs but AM is not so good and SSB does no produce any results. *W A Wilson.*

We have spoken to the author o 'Communication Building Blocks' (which mentions this receiver) and he was surprised to hear of your lack of success with SSB as he regards the ICF 2001 as a particularly good receiver. He mentioned that the best frequency oscillato (BFO) adjustment is rather sensitive and recommends that extreme care is exercised when setting this as it is easily possible to 'miss' the station when setting up. It would be interesting to know if other readers with the Sony have had similar experiences and we invite their views about it.

100W power amp

I am building a 100W power-amplifier similar to that described in your May and June 1983 issues. However, I wish to run a pre-amplifier off the±15V secondaries and I would like to know how much current I can draw off them while the ±42V secondaries are delivering 7A (after rectification).

Could you also advise me on how the current may be increased without sustaining loss of voltage. (The pre-amp runs off several voltage lines:-
± 15V, ±12V, ±9V, ±4.5V).
Alexander Bhinder, Herts.

The transformer specified for use in the 100W PA is rated at 250 VA, which means that if run within its ratings it can supply 3.0A total ie 1.5A from each of the 42V windings. When run at 100W o/p the amplifier draws approximately 1.1A from each of the windings, leaving several hundred milliamps spare capacity which should be enough for most preamplifiers.

Can you help me with problems that I am having with the acoustic modem (featured in the Feb 83 issue of Radio & Electronics World)? The band pass filter sections around IC1b and IC1c burst into self oscillation and cause the problems. Do you know of any cure for this?
M J Pearce, Cannock.

We have come across this problem before, due to a wrong value of resistor supplied in the kit. R4 should be 270R, but

27R was supplied. If this is not the problem, it is suggested that you check all values of resistors around the filter.

Would you please advise if, as a general rule, the receiver sections in transceivers are of higher quality than those in a 'straight' receiver?
G Young, Sydney, Australia.

As a general rule the receiver sections in transceivers are of no better quality than separate receivers. On the contrary, separate receivers should perform better because no compromises are necessary as in transceivers where often one or more sections of circuitry are shared between the transmitter and receiver sections.

'Poor man's spectrum analyser'

We have received a number of letters on this article which was reprinted from 73 Magazine, August 1982. We have no other information apart from that printed in the original article. The most commonly asked questions are:-

The value of the V.C.O. emitter resistor in *Figure 5* Nov R & EW?

In the original this is shown as a small stripline inductor! No dimensions are given, we suspect it just represents inductance of connections so return emitter lead to earth.

What are the components referred to as FT37-43, L43-12 and T37-6?

The FT37-43 is a toroidal core, the L43-12 is an RF transformer, both of these are manufactured by Amidon. The T37-6 is a toroidal core manufactured by Micrometals and available from Ambit International.

In *Figure 8* the transistors are 2N 2709 yet in the text they are referred to as 2N 2907?

They are 2N 2907.

In the L-PAO SAMPLER *(Figure 3)* what is 'FUSE ½in'?

This is described in original as ½ to ¾in length of hair thin wire.

The pin numbers are missing from one ¼of the op-amp in *Figure 8* , what are they?

Pin 5 is non inverting i/p. Pin 6 is inverting i/p. Pin 7 o/p.

Where can I get the TL 084C o/p amp?

This is a BiFet op-amp made by Texas and should be available from some of the advertisers in this magazine.

What are the dimensions of the Bandpass filter in *Figure 6* ?

The notes were accidentally left off this diagram which is reproduced below.

Doppler DF System

I am a final year degree student studying electrical and electronic engineering. As part of the course I have to do a project. I chose to base my project on the feature in June and July 1982 R & EW magazines, called 'A Doppler DF System'. Unfortunately in the feature there is no information on the programs for the two 74S287 PROM's which are used in the Control Voltage Waveform Generator. A.J. McKinnon (G4IQI), Stourbridge.

The complete set of parts is available from Doppler D.F. Systems, 5540 E. Charter Oak, Scottsdale, AZ 85254, USA. Tel: 602-998-1151

Printed circuit boards

I would be most interested to know if you, or an outside manufacturer, produce ready-made printed circuit boards for the projects that appear in R & EW.

I have searched through several copies and can find no reference to this. Edward Peak, West Kirby.

From now on you will see that PCB's for most projects are available from Edwardschild Ltd, 453a Becontree Ave, Dagenham, Essex RM8 3UL – Ed.

720 Channel air-band receiver (Sept 82)

Are there any modifications or different setting-up procedures for the TOKO KV1310 VHF tuning diodes that are used to increase the range, as suggested in Oct R & EW 1982?

Has there been a follow up article – if so when? A Simon, Edinburgh.

The lower end of the tuning voltage remains substantially as before but the 135MHz point will drop in voltage. This will cause some change of ratio between voltage and hum/noise level on the varicap line, thus it will be necessary to experiment with the levels. A follow-up has not been published.

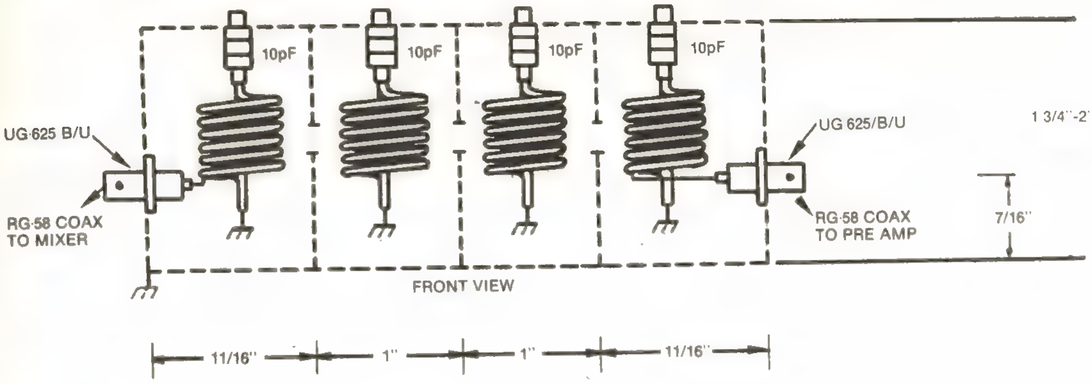


Fig 6 Bandpass filter

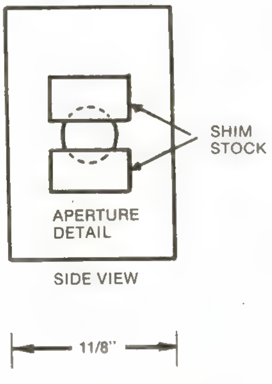
Note 1 *Coils are 6 turns of #12, ½in inside diameter, ⅝in long, taps at ¼ turn*

Note 2 *10p-F piston trimmer, Sprague-Goodman GGP8R500 or equivalent; alternate, air-variable, Johnson 189-564-1*

Note 3 *Filter box 1-⅛in deep made from single-/double-sided G-10 circuit board plus copper shim stock*

Note 4 *Mount BNC connectors near front side*

Note 5 *Coupling apertures are ⅜in x ⅜in. Drill ⅜in diameter holes in compartment wall pieces and then solder copper shim strips across tops and bottoms to narrow apertures*



IMPORTANT NOTICE

We are pleased to receive letters from readers either airing views or seeking technical information but regret that we are unable to enter into individual correspondence.

A selection of letters (and answers) will be published in Letters to the Editor and Questions & Answers each month.

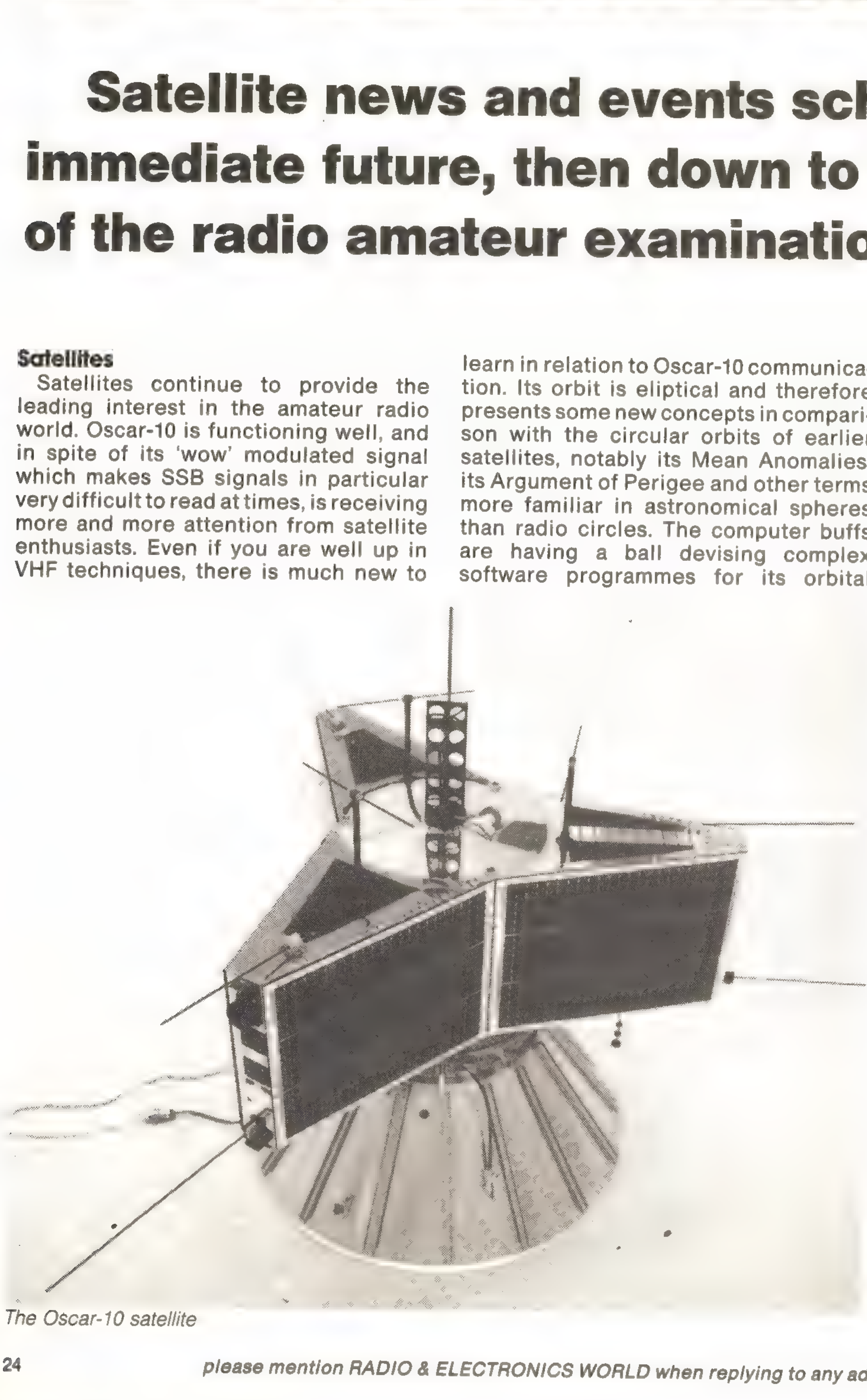
AMATEUR RADIO WORLD

Compiled by Arthur C Gee, G2UK

Satellite news and events scheduled for the immediate future, then down to earth discussion of the radio amateur examination and its validity

Satellites

Satellites continue to provide the leading interest in the amateur radio world. Oscar-10 is functioning well, and in spite of its 'wow' modulated signal which makes SSB signals in particular very difficult to read at times, is receiving more and more attention from satellite enthusiasts. Even if you are well up in VHF techniques, there is much new to learn in relation to Oscar-10 communication. Its orbit is eliptical and therefore presents some new concepts in comparison with the circular orbits of earlier satellites, notably its Mean Anomalies, its Argument of Perigee and other terms more familiar in astronomical spheres than radio circles. The computer buffs are having a ball devising complex software programmes for its orbital predictions and there seems no end to the new scientific disciplines which it is bringing into the satellite mode of amateur radio. If you want something really new to get into, Oscar-10 should provide all the mental stimulus you may be seeking! Our photo gives a very good impression of its aerials and it is not surprising that one got damaged at its separation from its launch vehicle, which has been responsible for the satellites characteristic 'wow'. At least its characteristic signals help to distinguish one's own 'up/down' signal from the multiplicity of stray signals one seems to find in the 2 metre satellite band!



The Oscar-10 satellite

Satellite news

The most exciting satellite news is that another UOSAT satellite is being built by Martin Sweeting and his team at the University of Surrey. This has now been given official approval and acceptance and its construction is already progressing well. The launch date is scheduled for March next, a tight programme indeed! It will be a similar project to UOSAT 1, but with improvements. The camera is to be improved and the digitalker will speak English – not American! Frequencies will be as UOSAT 1. The orbit will also be similar but should give signals over England in the mornings and afternoons – not midday as UOSAT 1. It should be noted that UOSAT's are designated 'A', 'B', 'C', etc, whilst on the ground and become UOSAT 1, 2, 3, etc, when launched. There is news too, of another satellite in the offing. The Japanese are planning one for launch in 1985-6. It is planned to have an orbit similar to the R.S. series atellites, with similar transponders plus 1269 MHz up, 436 MHz down, transpon-er. More on this as further information ecomes available.

he Shuttle

Taking advantage of a nearby suitable ocation, your scribe went out to see if he shuttle was visible in the NW evening ky as predicted on 28th November last.)f course, a cloud bank obscured the sky t 1620 UTC. Believe it or not, the cloud arted at the crucial moment and a good iew of it was obtained. Amateur radio ransmissions from it were not due until ive days into the mission and it's going o be very interesting to see how these vork out and who the lucky ones who btain contacts with it will be.

Whatever next?'

I could hardly believe my ears the other Sunday morning, when, trying to tune in he BARTG RTTY News Bulletin – 1st and 3rd Sundays at 1200 UTC, around 3590 KHz – several kc/s down the band, well nto the CW part of 80 metres, three over-modulated phone stations were having a natter using AM – yes, *amplitude modulation*! Well it's true that there seems to be a cult for 'things old' at the moment, but one did not expect to see it splashing over into amateur radio! 'And why not AM, you may ask?' Well, the whole object in present day amateur radio techniques is to keep QRM down and, whatever you may think about 'your rights', using AM in a crowded band like 80 metres on a Sunday morning is a bit 'anti-social'! True, AM is getting quite popular on 'Top Band', but up there it is on a band which is virtually unoccupied and anything which gets it used by radio amateurs is to be welcomed.

Radio amateur's examination

An awful lot is being said and written in the various amateur radio magazines at the moment about the RAE and the Radio Amateur's Examination is the 'hot topic' for discussion at the moment. As was pointed out in the RSGB's *Radio Communication* editorial for November last, 'The existence of the RAE depends directly on the International Radio Regulations which govern the operation of all radio communications, both professional and amateur, throughout the world. For those unfamiliar with it, the specific regulation states: 'National Administrations shall take such measures as they judge necessary to verify the operational and technical qualifications of any person wishing to operate the apparatus of an amateur station'.

There is much debate as to whether the present RAE does in fact ensure that the above quoted regulation is being covered. To quote from this editorial again, 'Equally important is the question of whether or not it covers the right ground. Many make the point that yesterday's amateurs often served a long apprenticeship as SWLs, frequently under the tutorship of experienced amateurs and as club members, thus they did not need to be tested on practicalities. Many of today's amateurs, while being proficient technically, are often unfamiliar with general operating procedures which the more experienced take for granted, but which are part of neither the syllabus nor the examination.' How true! If we are going to have high powered AM transmitters back on to all the HF bands, chaos is going to rule!

Amateur licences

The Department of Trade and Industry states that at the end of June 1983, there were 23,204 Class A amateur radio licences, 22,904 Class B licences and 1,694 reciprocal licences issued to overseas amateurs whilst visiting this country or resident therein. The G5 plus three letter call signs are being phased out at the end of 1983. Reciprocal call signs will be of the G4/callsign of the overseas licencee type. Three types of reciprocal licence will be issued, ie, mobile for 2 metres, temporary for up to one year and permanent licences for long term overseas residents in the UK.

From September last, amateur radio licencing was transferred from the Radio Regulatory Division of the Department of Trade & Industry, back to the Post Office. It is anticipated that computerisation of the records will result in much speedier processing of these records than before. The address of the Department concerned is now: Radio Amateur Licensing Unit, Chetwynd House, Chesterfield, Derbyshire S49 1PF.

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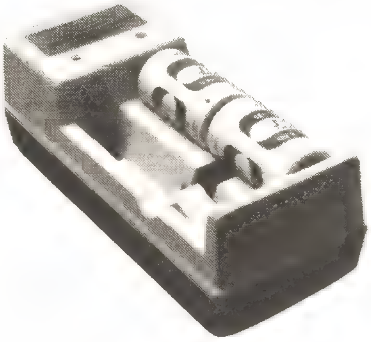

NiCAD Batteries

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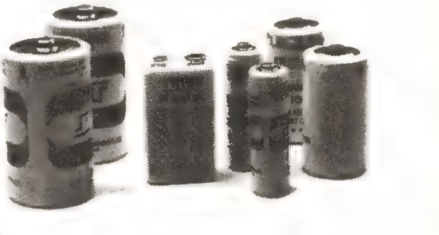
1/3AA*	0.10	18.0	14.3	1.58	1.50	1.44
1/2AA*	0.24	28.1	14.3	1.45	1.37	1.32
AA	0.50	50.2	14.3	0.90	0.85	0.82
AA*	0.50	50.2	14.3	0.96	0.91	0.88
1/2A*	0.45	28.1	17.3	1.53	1.45	1.38
RR*	1.20	42.1	22.6	1.70	1.61	1.52
C	2.20	49.7	25.9	2.40	2.30	2.20
D (sub)	1.20	60.5	32.9	2.40	2.30	2.20
D	4.00	60.5	32.9	3.50	3.32	3.15
D*	4.00	60.5	32.9	3.59	3.41	3.24
F*	7.00	91.3	32.9	6.85	6.50	6.20
SF*	10.00	91.3	41.7	10.50	9.50	8.90
PP3	0.11	49 × 26.5 × 17.5		4.35	4.10	3.85

* Denotes cell fitted with solder tags



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AC.1 SAFT MAZDA AA charger, charges 1 to 4 AA cells **£5.90** MC.2 ALTAI MULTICHARGER, charges 1 to 4 AA, C & D cells plus 1 PP3 cell, also cell test facilities **£8.50** PC.3 SAFT MAZDA PP3 charger, charges 1 of 2 PP3 cells **£5.90** MC.4 JECKSON MULTICHARGER, charges 2 of 4 AA, C & D cells **£7.00** MC.5 JECKSON MULTICHARGER, charges 2 of 4 AA, C & D cells, or 1 of 2 PP3 cells **£8.50**

BNOS Electronics (Dept RE) Greenarbour, Duton Hill, Great Dunmow, Essex, CM6 3PT
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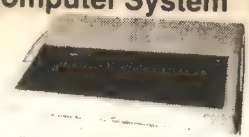

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BBC Mod B · disk interface	£409 · VAT	£469.00
BBC Mod B · Econet interface	£389 · VAT -	£447.35
BBC Mod B · disk and Econet interfaces	£450 · VAT	£517.50
BBC 100K disk drive	£230 · VAT	£264.00
BBC dual 800K disk drive	£699 · VAT	£803 85
Torch Z80 disk pack including Z80 2nd processor 64K RAM and CPN operating system	£699 · VAT	£803.85
BBC Teletext receiver (Aug)	£196 · VAT	£225 40
BBC cassette recorder and lead	£26 · VAT	£29 90
Disk interface kit (free fitting)	£86 · VAT	£96.60
Mod A to Mod B upgrade kit	£50 · VAT	£57.50
Fitting charge for A to B upgrade kit	£20 · VAT	£23.00
16K memory upgrade kit	£20 · VAT	£23.00
Games paddles	£11 · VAT	£12.65
12 Monochrome monitor incl cable	£89 · VAT	£102.35
16 Colour monitor incl cable	£239 · VAT	£274 85
User guide	£10 · VAT	£10.00
Econet interface (free fitting)	£60 · VAT	£69 00
Speech interface (free fitting)	£47 · VAT	£54 05
BBC disk manual · formating disk	£30 · VAT	£34 50
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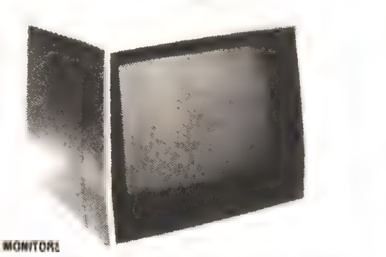

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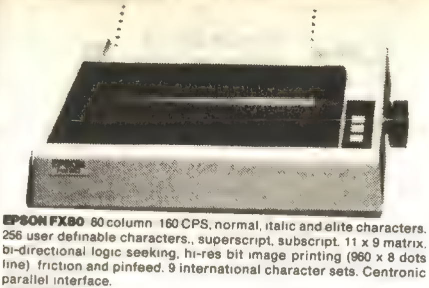

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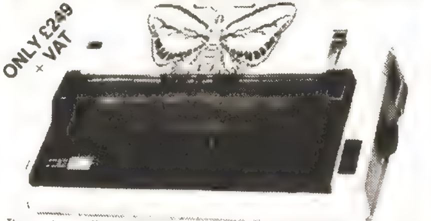

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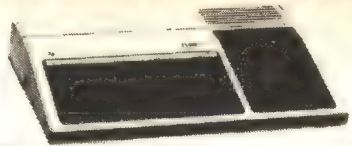

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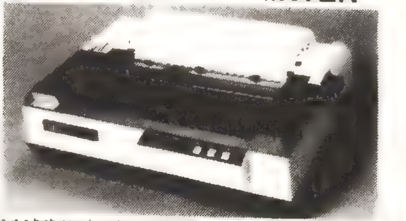

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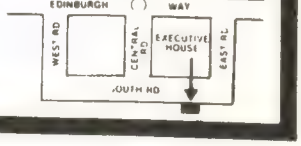
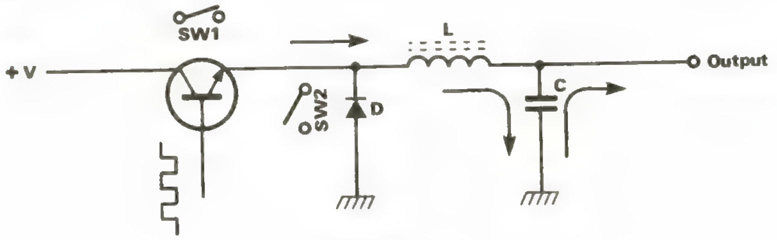


SWITCHED MODE POWER SUPPLIES

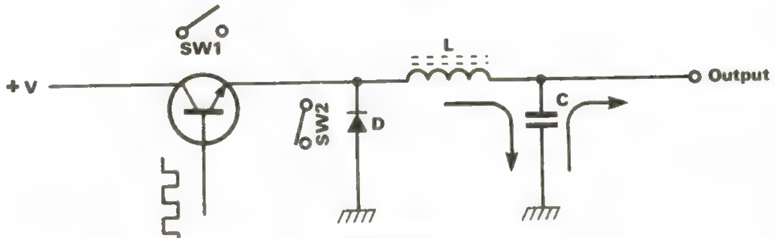
This PSU is small, efficient and has low operating temperature

The switched mode power supply (SMPSU) presents a viable alternative to the older linear power units that have been in vogue for many years. Although offering many advantages such as ease of design and construction, the linear power supply is a bulky and heavy, inefficient unit with problems in heat dissipation, etc. The SMPSU, conversely, is a little more difficult to design but is small, extremely efficient and presents few problems of heat dissipation.

Because the circuits tend to be complex, the semiconductor manufacturers have provided a range of integrated circuits that very much simplify the design of the SMPSU. Typical are the NE5560, and the SG1526 which are popular with the professional designer, offering advantages such as temperature compensation, remote operation and soft start (slow rise to full voltage) as optional facilities. These options are in addition to the standard facilities which include over-voltage protection and current limiting.



(a) SW1 'on'



(b) SW1 'off'

NOTE: Arrows indicate direction of conventional current flow

Fig 1 *Simplified operation of Buck Regulator*

How they work

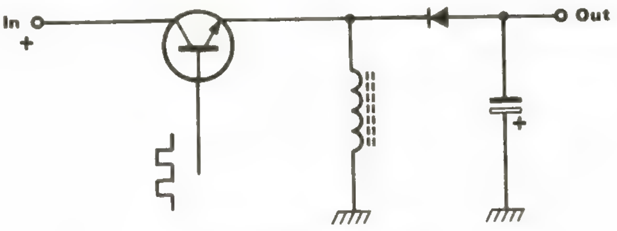
A very basic circuit is illustrated in *Figure 1.* If we operate the transistor switch (SW1) at a very fast rate we will obtain a square wave output at a frequency equal to the switched rate. The peak-to-peak output is equal to the input voltage, but the average voltage is equal to the peak voltage multiplied by the ratio of the 'on' time to the 'off' time. This figure can be realised by passing the switched voltage through a switched LC filter (as shown). This type of circuit is known as a 'buck regulator'.

The operation of the filter is relatively simple and acts as follows:-

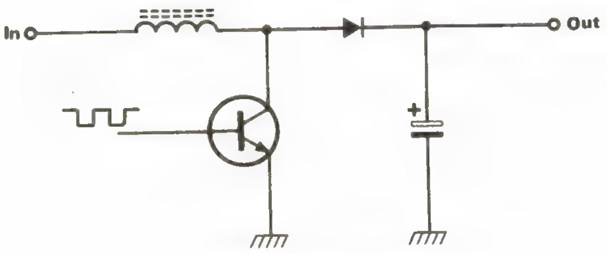
Switch (SW1) 'on' – the capacitor is charged via the inductor. Since the rate of charge is high, the inductor will exhibit a high impedance thus limiting the rate. Simultaneously, the inductor will form a magnetic field. The values of the capacitor and inductor are chosen such that the full input voltage of the switch will not be realised during this period of operation, ie the time constant exceeds the time period for a full cycle of the switched input.

Switch (SW1) 'off' – the capacitor now has a positive charge which can be supplied to the load. The current through the inductor becomes zero which causes the magnetic field to collapse. This results in an emf being generated which has a polarity opposite to that experienced during the 'on' period. This emf will result in the diode switch (SW2) being turned 'on' and so placing the inductor in parallel with the capacitor and adding its back emf to the charge held in the capacitor.

By rearranging the circuit it is possible to alter the operation of the regulator to achieve an output voltage that is (a) the opposite of the input voltage or (b) that is greater than the input voltage. These circuits are shown in *Figure 2.*



(a) Inverting Configuration



(b) Step up configuration

Fig 2 *Configurations*

Practical designs – which IC?

As was previously mentioned, the NE5560 is already popular and so is readily available. However, before we can start on the actual design it is necessary to understand how the NE5560 works (block diagram shown in *Figure 3*).

The NE5560

PINS 1,2 and 12 – these are connected to the stabilised power supply which, at voltages below 18V, is operated as a normal series stabiliser to give an output of approximately 8.5V (Vz), available at pin 2 (max 5mA current). When input voltages exceed 18 volts, pin 1 is current fed via a resistor, and when this method is used on chip components, limit the voltage to approximately 23V at 10mA or 30V at 30mA. When operated at 12V the IC will consume approximately 10mA, provided the pin 2 is open circuit and the resistance between pins 7 and 12 exceeds 20kilohms (pin 12 is usually grounded).

PINS 7,8,9 and 16 – the sawtooth generator that is the heart of the circuit is accessed at these pins. A resistor between pins 7 and 12 determines the constant current that charges a capacitor connected between pins 8 and 12. This results in a voltage which starts at 1.1V, linearly increases to 5.6V and then resets, the time for this operation being determined by the values of the resistor and capacitor. *Figure 4* shows a plot of oscillator frequency versus the timing components. If necessary, the NE5560 can be synchronised with an external oscillator by making the free-running frequency higher than the input and injecting synchronising pulses into pin 9.

Pin 16 is the feed-forward input, and adjusts the charging current of the capacitor to allow for variations of the input voltage. The voltage on this pin is normally set midway between Vz and the input voltage Vcc.

PINS 3 and 4 – these pins access the error amplifier, which has an open loop gain of 60dB, and is connected to the output of the SMPSU (usually via a potential divider). The gain of this amplifier will set the output regulation. For most practical purposes a gain of 100 is usually adequate.

PIN 6 – normally connected to a potential divider between Vz and ground, it determines the maximum duty cycle of the pulse-width modulator (PWM). *Figure 5* demonstrates the relation between the resistance ratios and the maximum duty cycle (which determines maximum output voltage). A capacitor between pin 6 and ground defines the 'soft start' characteristics, such that the higher the capacitance the slower the rise of output voltage from zero to operating voltage.

PIN 5 – this provides a facility for an external pulse-width modulator facility. Normally, when the power supply is an independent unit, it is not connected unless a constant current supply is required.

PIN 11 – this pin provides the

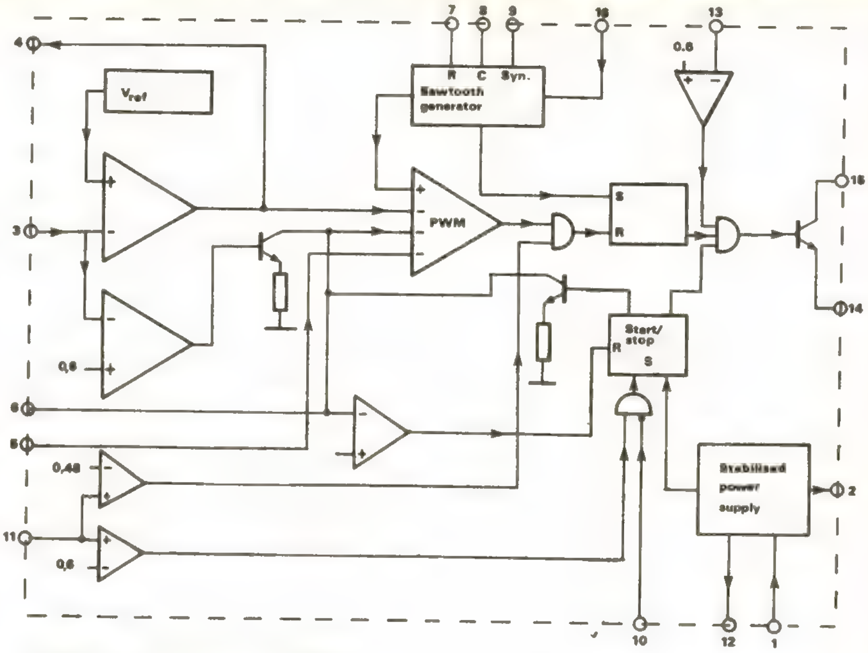


Fig 3 *Block diagram of NE5560*

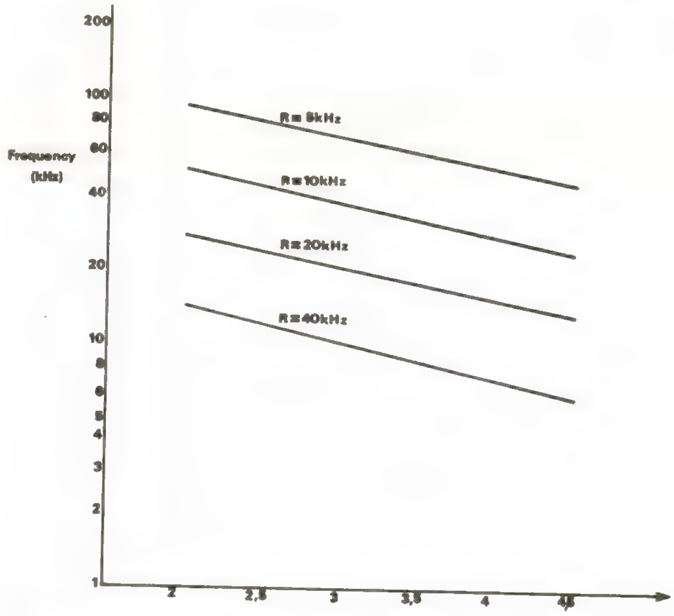


Fig 4 *Effects of timing components on frequency*

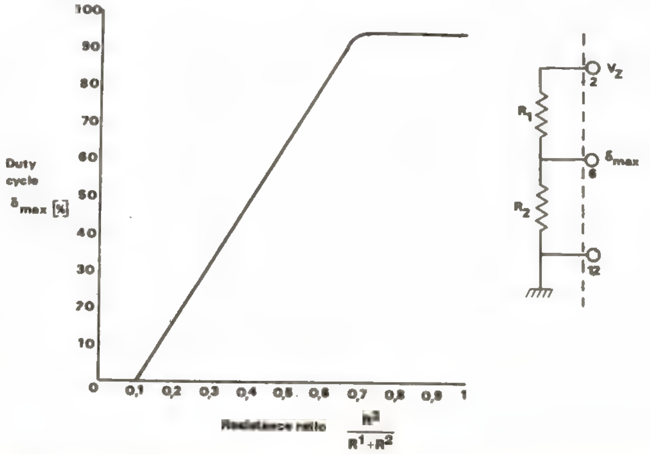


Fig 5 *Relationship between resistance ratios and maximum duty cycle*

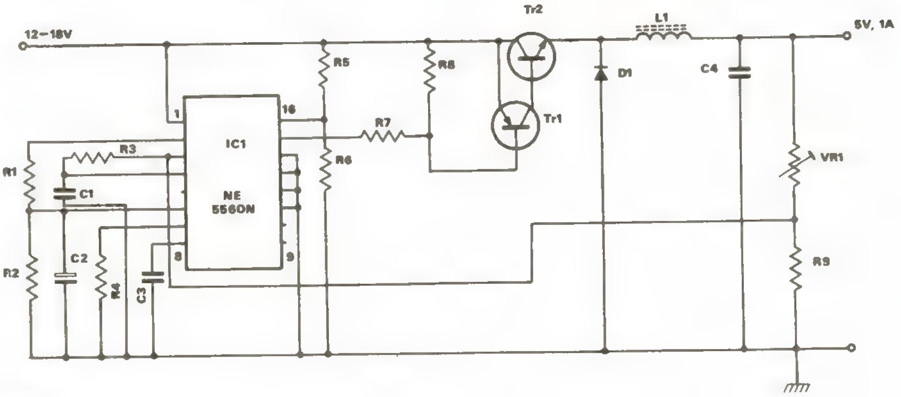


Fig 6 *5V 1A SMPSU*

PARTS LIST

R1,R2	10K	R6	8K2	C1	2n7	TR1	TIP41A
R3	100K	R7	2K2	C2	47µ	TR2	2N3638A
R4	22K	R8	220R	C3	2n7	D1	BYW29
R5	1K5	R9	3K9	C4	470µ	L1	900µH
		VR1	4K7			IC1	NE5560N

vercurrent protection and if the input oltage exceeds 0.48V, the PWM reduces ne duty cycle and the output voltage rops. When minimum duty cycle is eached the PWM output is inhibited if ne fault persists or if the input voltage xceeds 0.6V. After a certain 'dead time' ne circuit will try to restart but will again nhibit if the faults persist. This procedure is termed the 'hiccup' mode.

PIN 10 – this is a remote on/off facility nat is seldom used in normal practice. he input is TTL compatible and, when eft floating or connected to a voltage xceeding 2V, allows the IC to function ormally. When reduced below 0.8V it nhibits the output of the PSU.

PINS 14 and 15 – these are the emitter nd collector of the output transistor and re capable of sourcing or sinking a naximum of 40mA with a saturation oltage lower than 0.5V. Although not hown in the drawing a clamping diode rom the collector to the input voltage rotects against over-voltage.

PIN 13 – used in circuits with transforners in the output circuit. It inhibits the utput transistor when the input level xceeds 0.6V. The facility is usually riven from a winding on the output ransformer (when used) and prevents he core from being saturated. If not sed this pin should be grounded.

he final design

With the information given it is now ossible to generate most of the design or a basic power supply. As an example e will consider the parameters for a 5 volt 1 ampere unit as shown in *Figure 6.*

Resistors R1 and R2 determine the maximum duty cycle and thus the overvoltage limit before the shutdown occurs (PSU turns off). Since we are considering a 5V unit a minimum shutdown voltage of 6V will be used. The second factor which determines the duty cycle is the minimum input voltage. Reference to the manufacturers data shows that this is 11 volts for the NE5560 and the maximum duty cycle will, therefore, be 54.5% (Output voltage maximum – input voltage minimum). Reference to *Figure 5* will now give us a resistance ratio of 0.42:1 and if we let R1=10k this will give us a value for R2 of 7.24k. Unfortunately the nearest standard value of 6.8k will cause shutdown at 4.5V so it is necessary to use 8.2k. Alternatively a preset potentiometer could be used to set the overvoltage limit and if the PSU is to be used for operating TTL circuits it would in fact be recommended since these IC's have a maximum rating of 7V.

The soft start facility is provided by C2 and can be varied according to the users requirements. Omission is not recommended since voltage overshoot can occur, possibly resulting in damage to the unit being supplied. In practice a value of 47µF was found to be adequate for most applications. The error amplifier gain is controlled by R3 in conjunction with VR1 and R9. Since, as has been previously stated, a gain of 100 is adequate the value of 100k was used for R3. C1 is used to limit the bandwidth of the error amplifier and so remove any possibility of high frequency instability.

Operating frequency

The operating frequency is determined by R4 and C3, whose values are determined from *Figure 4.* By convention, a frequency of 25kHz was used, which results in values of 22 kilohms and 2200 pF respectively. Higher operating frequencies can be used with the resulting increase in efficiency and reduced values (and sizes) of the output LC filter. However, this would also result in increased price for the switching transistor and an increase in radio frequency radiation.

Inductor and capacitor values

We now reach the most important part of the design and also the so far unspecified section, namely the values of inductor and capacitor in the output LC filter. The methods used for specifying the values of these components vary and in order to avoid complex formulae, the following equations were formulated:-

$$L = \frac{Vo - \frac{Vo^2}{Vmin}}{2f.\ Imin} \simeq 900\ \mu H \qquad \text{and} \qquad C = \frac{Imin\left(1 - \frac{Vo}{Vmax}\right)}{4Vr.f\ \frac{(1 - Vo)}{Vmin}} \simeq 470\ \mu F$$

Where Vo = Output voltage (5V)
Vmin = Minimum input voltage (11V)
Vmax = Maximum input voltage (18V)
Vr = Output ripple voltage
f = Switching frequency (25 kHz)
Imin = Minimum output current (100mA)
I = Maximum output current (1A)

No originality is claimed for these since it is possible for any competent engineer to derive them from available information. Although the values obtained are not optimum, they are close enough to satisfy most requirements.

Once the values are known it is then necessary to specify the components in detail, this especially applies to the inductor since it acts as an energy storage device and if a random inductor is used it will probably result in the demise of the PSU. Fortunately Micrometals Inc. make the specification of this component very much easier than it might otherwise have been.

It is first necessary to determine the amount of energy storage that is required. This is derived for the simple equation $Q = 0.5LI^2$ where L is the inductance value (in Henries) and I is the maximum current rating of the power supply (in amperes). Reference is then made to graphical data on the available cores (see *Figure 7*) and a suitable core is chosen. Once we have our core, further reference to the data is made and the value of AL is extracted (for the T106-26 core this is 900) and is inserted, along

$$N = \frac{L \times 10^6}{A_L\,[100 - \text{Sat}]}$$

Where N is number of turns
L is inductance in microhenries
A_L is a constant for core in use
Sat is percentage saturation
(extracted from *Figure 7*)

with the inductance value, into the equation for N above.

Now wind the inductor using wire of sufficiently large gauge to carry the current but small enough to enable the turns to fit onto the toroid. Purists may add additional requirements but it is felt that the above is sufficient for most applications.

The capacitor used should be suitable for the type of application. It should have low self inductance and low ESR (equivalent series resistance) and, hence, a high self resonant frequency. Operation above this frequency results in the capacitor exhibiting inductive characteristics. In this particular design it is possible to use a general purpose type of electrolytic, although the output ripple performance is degraded. However, if larger values of capacitance or a higher frequency is used, it is strongly recommended that a purpose built capacitor is used.

In the design example we have been using, the inductor and capacitor settled on were as follows:-

L = 900μh and is composed of 100 turns of 22 SWG enamelled wire wound on Micrometals toroid, type T106-26
C = 470μF 25V

Conclusion

The information given concerns a design based on pure theory, but in practice not many components are perfect so minor modification to the circuit was required. Only one component, R2, was affected and it was found necessary to increase this value from the 8.2k calculated to 10Kilohm.

Performance of the supply was not quite equal to the design, this being affected by variables such as the ESR of the capacitor and the DC resistance c the inductor. The output ripple was 50m P-P (equal to 17.5mV rms) and not 10m as was anticipated in the design limitations. Other than this, the circuit worke admirably. The following limitation mus be borne in mind by readers who wish t design their own power units: with th type of core specified the output voltag must not exceed half the input voltage o the core will saturate. If you wish to d this, there are saturable cores availabl but the design work is a little mor complex than that previously describe

Users of this type of supply shoul ensure that there is adequate filtering a the input and output of the unit. In mos applications, 0.1μf capacitors are adequate but in certain situations, e.g. when R equipments are present, a more thorough procedure may be required However having said this, it is pointe out that this type of PSU is ideal fo transmitter power amplifiers. When use as such, transmit keying can be accomplished by using the remote on/of facility on pin 10 of the NE5560.

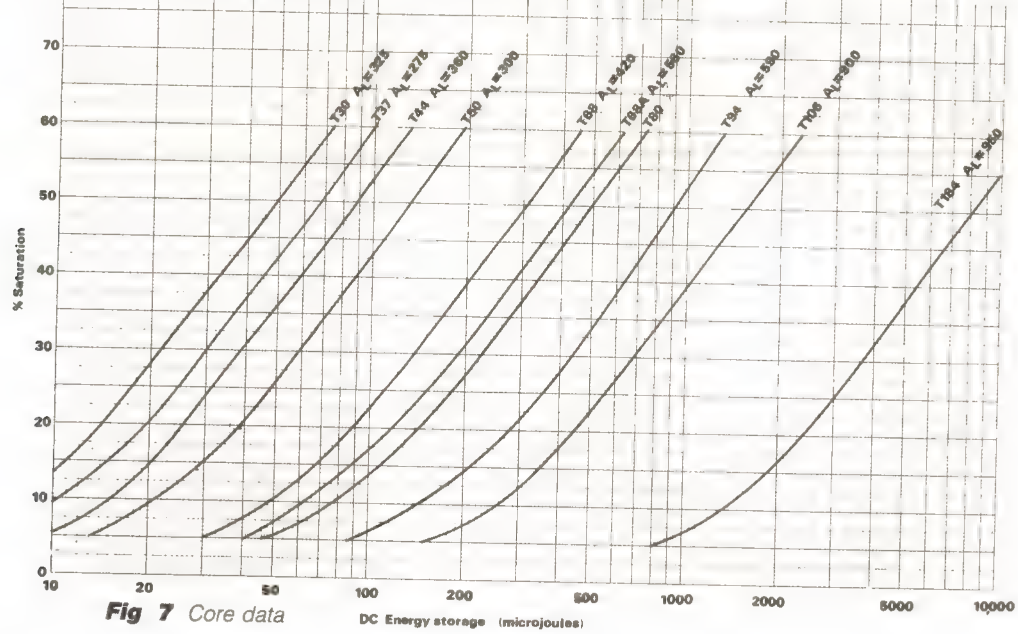


Fig 7 *Core data*

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W22 or sim 6 watt	7 for **£1.00**
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W23 or sim 9 watt	6 FOR **£1.00**
OR1, 1R0, 3R0, 6R8, 56R, 62R, 100R, 270R, 1K8, 10K.	
W24 or sim 12 watt	4 FOR **£1.00**
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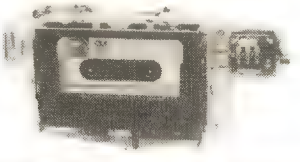

Front loading deck with full solenoid control of all functions including optional read in fast wind modes 12 volt operation. Fitted 3-digit memory counter and Hall IC Motion Sensor Standard erase and stereo R/P Heads Cheapest price ever for all these features. Only **£38.90** plus VAT. Full technical specification included

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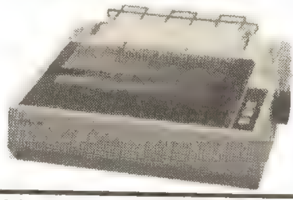

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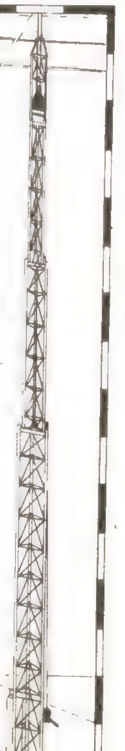


One Night's Work

'Crowbar' Protection circuit to ensure your equipment doesn't go 'bang'

by Stephen Ibbs G4LBW

If you have an expensive item of equipment connected to a dc supply, the last thing wanted is a power supply fault which may possibly cause your precious equipment to go 'bang'. What is needed is a protection circuit that will sense any voltage rise and blow the fuse before damage occurs to the rig!

Specialised IC, MC3423

A specialised IC, labelled MC3423 has been developed for just such a purpose. It works by sensing the voltage of the power-supply continuously and as soon as it rises above a predetermined point, set by VR1 it trips, turning on the external thyristor. Once on, a thyristor latches and acts almost like a short-circuit across the supply terminals – hence the common name for this type of circuit a 'crowbar'. It's like putting a crowbar across the terminals. This will cause the fuse of the power supply (assuming one has been fitted – as it should!) to blow.

Noisy supply lines

It may be that the supply lines are 'noisy' and cause the device to trip unnecessarily. To counteract this, a capacitor can be inserted between pin 4 and earth. In this case pin 3, normally connected to pin 2, would *instead* be connected to pin 4. The value of the capacitor determines the delay before the thyristor is turned on, with 1000pf giving 10μS delay, and 1.0μF giving 10mS delay. In use, VR1 is simply adjusted so that if, for example, the equipment requires 13.8μF, the thyristor fires at 15V. (Note: the prototype had 0.47μF fitted between pins 3, 4 and earth).

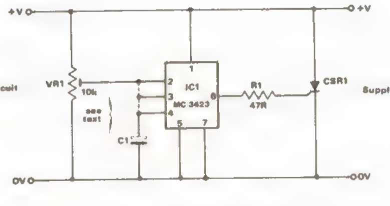


Fig 1 *'Crowbar' protection circuit*

Pcb designed

A pcb has been designed, and there should be no problems provided care is taken to mount the components the correct way round. Voltages above 36V should not be used and the choice of thyristor depends on the current it may have to carry. The one selected for the prototype will handle 2.5 amps, and turns on in 1-2μS, but this can be changed easily to cater for other requirements. Supply switch-on may cause a spurious spike which will cause the thyristor to be triggered so, if possible, the rise time should be slowed down. Preferably switch on, and turn the voltage up from 0V to the desired supply level.

PARTS LIST

R1	47Ω
VR1	10k min horiz preset
CSR1	C106D thyristor
C1	see text
IC1	MC3423

Note: The MC3423 is stocked by R S Components and can be ordered via your local component shop. All other components, including the thyristor are widely available.

PCB for this project is available from Edwardschild Ltd, 453a Becontree Ave, Dagenham, Essex RM8 3UL at 99p each.

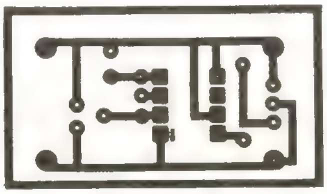


Fig 2 *PCB foil pattern corresponding to Figure 1*

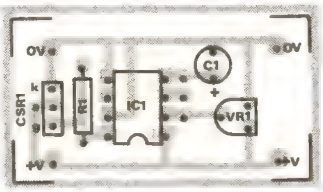
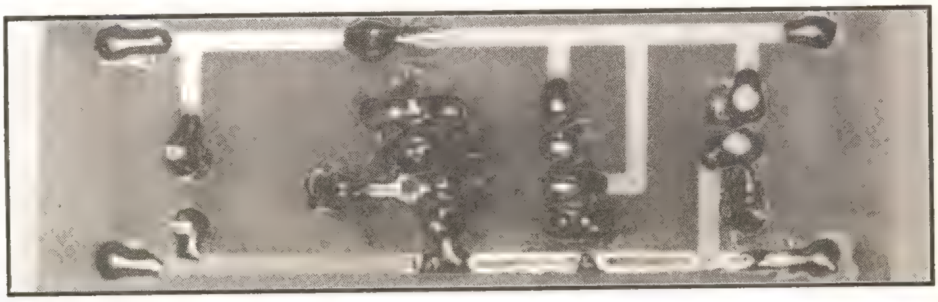
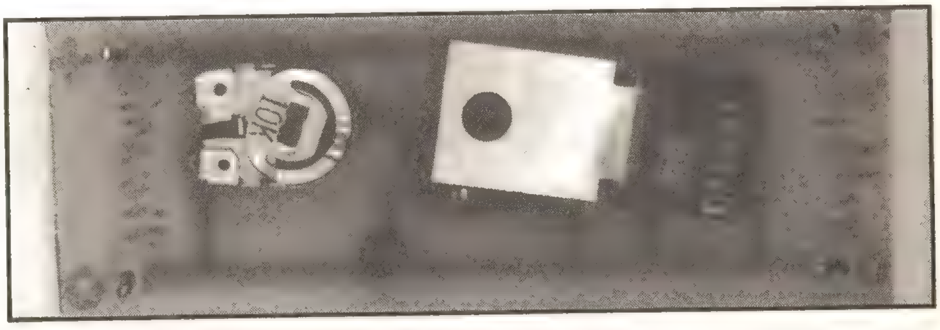


Fig 3 *Component overlay*





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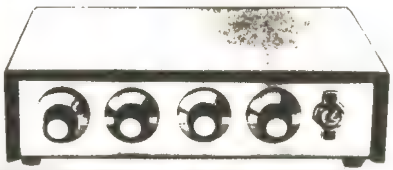
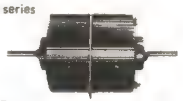
8 POWERFUL MODEL MOTORS (all different)

for robots, meccanos, drills, remote control planes, boats, etc. **£2.95.**



Complete kit of parts for a three channel sound to light unit controlling over 2000 watts of lighting. Use this at home if you wish but it is plenty rugged enough for disco work. The unit is housed in an attractive two tone metal case and has controls for each channel, and a master on/off. The audio input and output are by ¼" sockets and three panel mounting fuse holders provide thyristor protection. A four pin plug and socket facilitate ease of connecting lamps. Special price is **£14.95** in kit form or **£25.00 assembled and tested.**

12 volt MOTOR BY SMITHS



Made for use in cars, etc. these are series wound and they become more powerful as load increases. Size 3½" long by 3" dia. They have a good length of ¼" spindle – **Price £3.45.**

Ditto, but double ended **£4.25.**

Ditto, but permanent magnet **£3.75.**

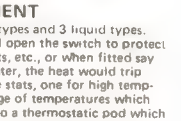
EXTRA POWERFUL 12v MOTOR

Probably develops up to ¼ h.p so it could be used to power a go-kart or to drive a compressor, etc. **£7.95** + **£1.50** post.

THERMOSTAT ASSORTMENT

10 different thermostats. 7 bi-metal types and 3 liquid types. There are the current stats which will open the switch to protect devices against overload, short circuits, etc., or when fitted say in front of the element of a blow heater, the heat would trip the stat if the blower fuses; appliance stats, one for high temperatures, others adjustable over a range of temperatures which could include 0 – 100°C. There is also a thermostatic pod which can be immersed, an oven stat, a calibrated boiler stat, finally an ice stat which, fitted to our waterproof heater element, up in the loft could protect your pipes from freezing. Separately, these thermostats could cost around £15.00 - however, you can have the parcel for **£2.50.**

MINI MONO AMP on p.c.b., size 4"x 2" (app.)



Fitted volume control and a hole for a tone control should you require it. The amplifier has three transistors and we estimate the output to be 3W rms. More technical data will be included with the amp. Brand new, perfect condition, offered at the very low price of **£1.15 each, or 10 for £10.00.**

– BARGAIN OF THE YEAR –

The AMSTRAD Stereo Tuner.

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Other uses are as a "get you to sleep radio", you could even take it with you to use in the lounge when the rest of the family want to view programmes in which you are not interested. You can listen to some music instead.

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Offered at a fraction of its cost: **only £6.00**
+ £1.50 post + insurance.

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- 1 manual reversing & on/off switch
- 1 push to start switch
- 2 limit stop switches
- 1 circuit diag. of connections

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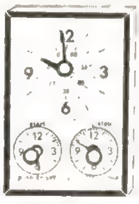

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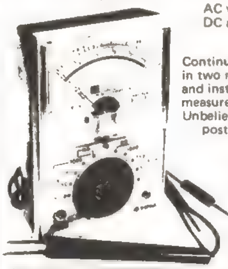

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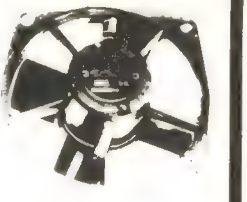

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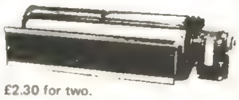

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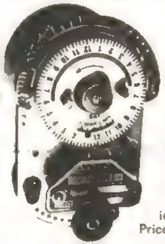

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DATA FILE

Ray Marston continues his survey of op-amp principles and applications by looking at various oscillators and switching circuits

In the last two editions of 'Data File' we've taken an in-depth look at the operating principles of conventional voltage-differencing operational amplifiers, and at various practical ways of using them to make linear amplifiers and active filters. This month, we look at ways of using op-amps to make various types of oscillators and switching circuits.

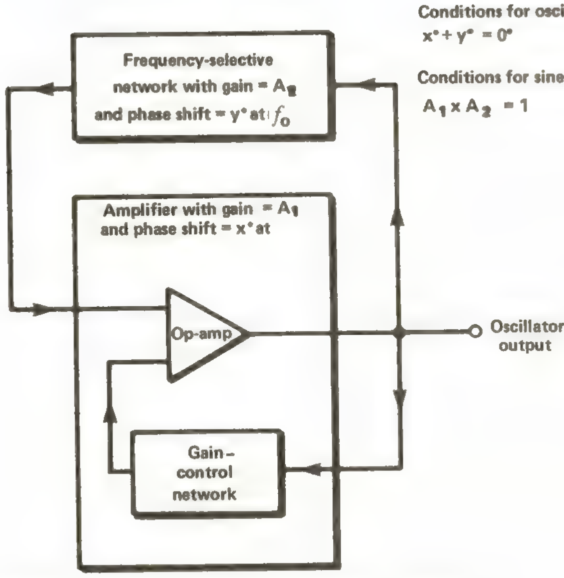

Conditions for oscillation:–
x° + y° = 0°
Conditions for sine-wave generation:–
A1 x A2 = 1
Frequency-selective network with gain = A2 and phase shift = y° at fo
Amplifier with gain = A1 and phase shift = x° at
Op-amp
Oscillator output
Gain-control network

Fig 1 *Conditions for stable sine-wave oscillation*

Sine-Wave Oscillators

An op-amp can be made to act as a sine-wave oscillator by connecting it as a linear amplifier in the basic configuration shown in *Figure 1*, in which the amplifier output is fed back to the input via a frequency-selective network and the overall gain of the amplifier is controlled via a level-sensing system. For optimum sine-wave generation, the feedback network must provide an overall phase shift of zero degrees and a gain of unity at the desired frequency. If the overall gain is less than unity the circuit will not oscillate, and if it is greater than unity the output waveform will be distorted.

One practical way of implementing the above principle is to connect a Wien Bridge network and an op-amp in the basic configuration shown in *Figure 2*. The frequency-sensitive Wien Bridge network is constructed from R1-C1 and R2-C2. Normally, the network is symmetrical, so that C1=C2=C, and R1=R2=R. The main feature of the Wien network is that the phase relationship of its output to input signals varies from −90° to +90°, and is precisely 0° at a centre frequency (fo) of 1/6.28CR. At this centre frequency the symmetrical network has a voltage gain of 0.33.

Thus, in the *Figure 2* circuit, the Wien network is connected between the output and the non-inverting input of the op-amp, so that the circuit gives zero overall phase shift at fo, and the actual amplifier is given a voltage gain of x3 via feedback network R3-R4, to give the total system an overall gain of unity. The circuit thus provides the basic requirements for sine-wave oscillation. In practice, however, the ratios of R3-R4 must be very carefully adjusted to give the overall voltage gain of precisely unity that is necessary for low-distortion sine-wave generation.

The above circuit can easily be modified to give automatic gain adjustment and amplitude stability by replacing the passive R3-R4 gain-determining network with an active gain-control network that is sensitive to the amplitude of the output signal, so that gain decreases as the mean output amplitude increases, and vice versa. *Figures 3 to 7* show some practical versions of Wien Bridge oscillators with automatic amplitude stabilisation.

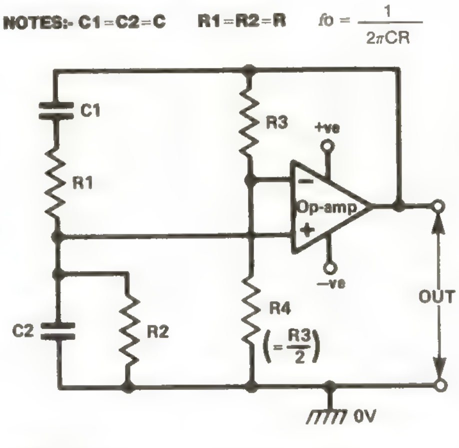


Fig 2 *Basic Wien-Bridge sine-wave oscillator*

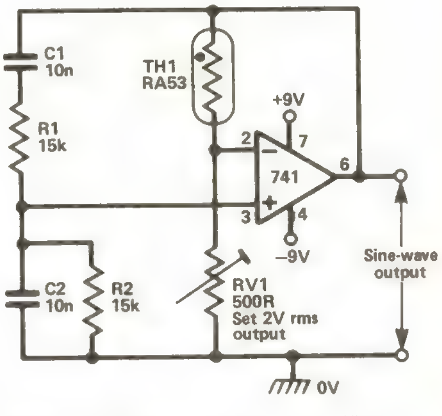
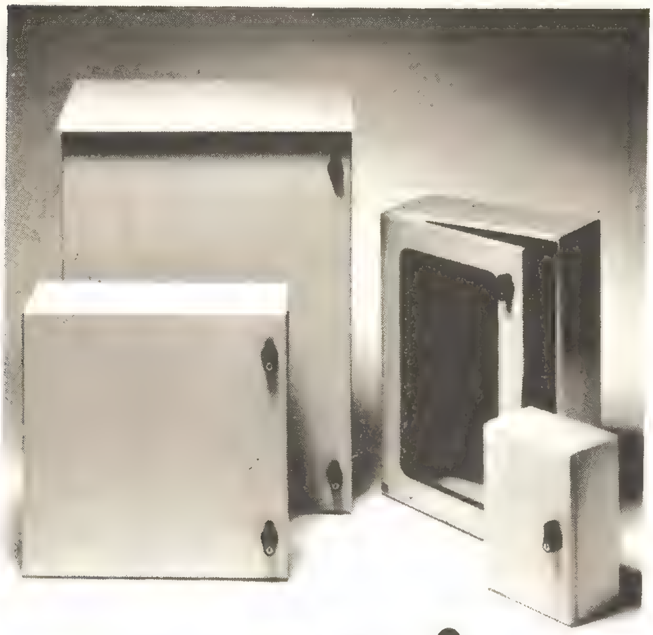


Fig 3 *Thermistor stabilised 1kHz Wien Bridge oscillator*

Thermistor-Stabilised Circuits

In the 1kHz fixed-frequency oscillator circuit of *Figure 3* the output amplitude is stabilised by an RA53 (or similar) negative-temperature-coefficient thermistor. TH1 and RV1 form a gain-determining feedback network. The thermistor is heated by the mean power output of the op-amp, and at the desired output signal level has a resistance value double that of RV1, thus giving the op-amp a gain of x3 and the overall circuit a gain of unity. If the oscillator output amplitude starts to rise, TH1 heats up and reduces its resistance, thereby automatically reducing the gain of the circuit and stabilising the amplitude of the output signal.

An alternative method of thermistor stabilisation is shown in *Figure 4*. In this case a low-current lamp is used as a positive-temperature-coefficient thermistor, and is placed in the lower part of the gain-determining feedback network.



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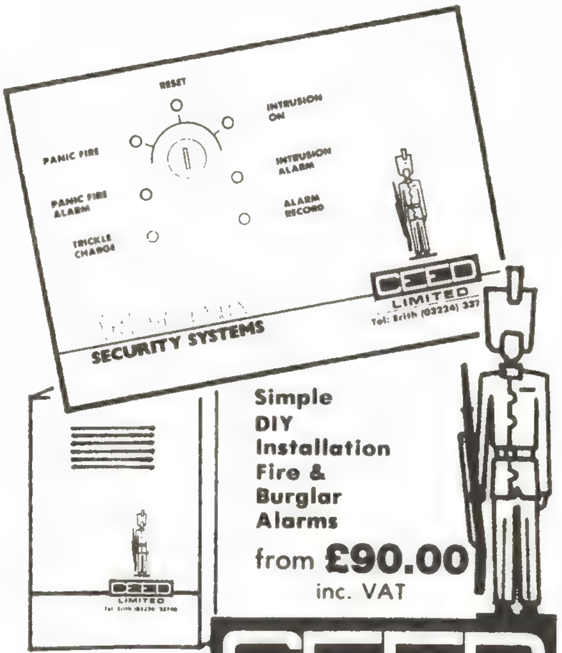

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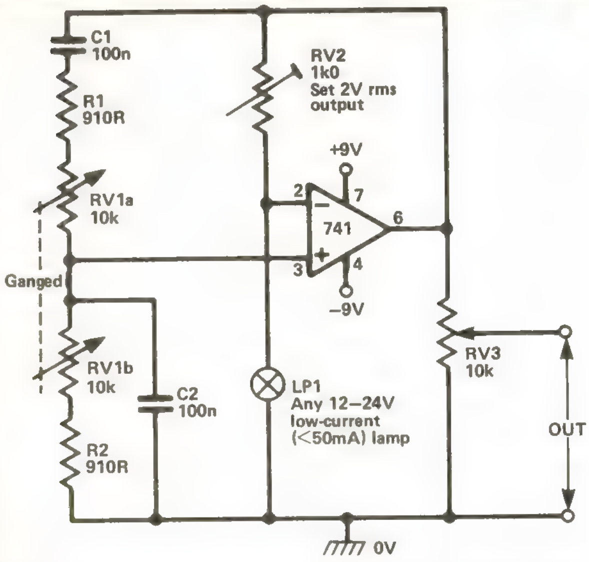

Fig 4 *150 Hz – 1.5kHz lamp-stabilised Wien-Bridge oscillator*

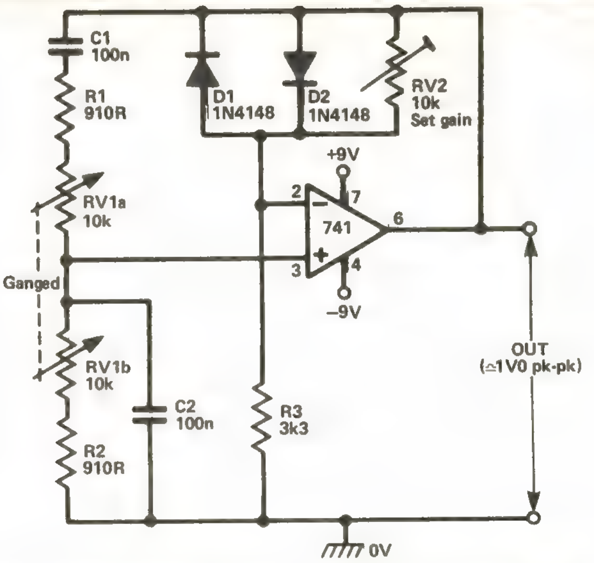

Fig 5 *Diode-regulated 150Hz – 1.5kHz Wien Bridge oscillator*

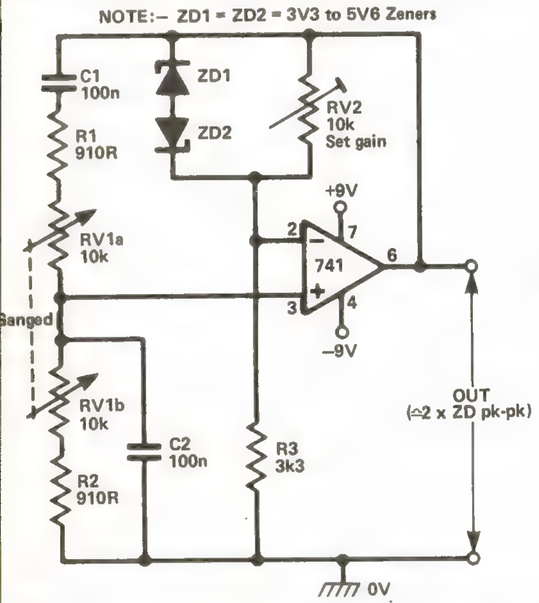

Fig 6 *Zener-regulated 150Hz – 1.5kHz Wien Bridge oscillator*

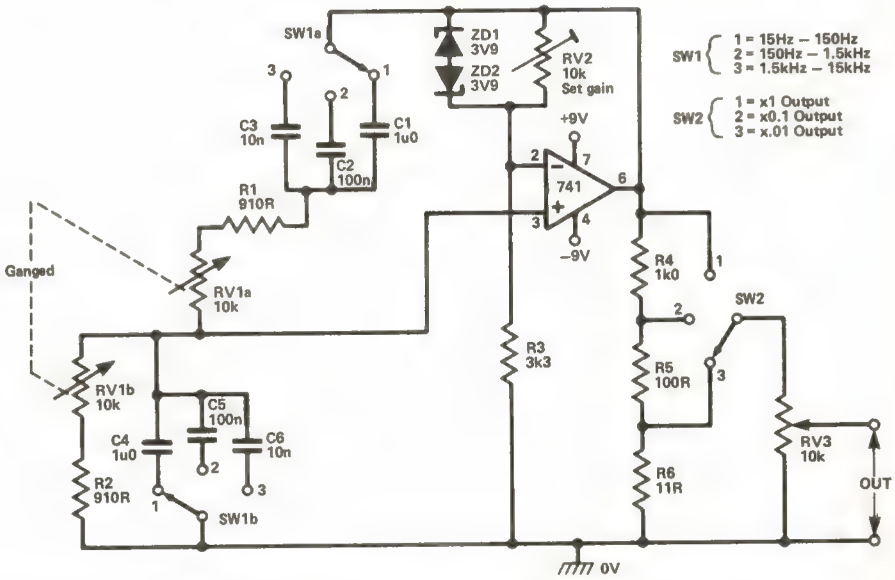

Fig 7 *Three-decade (15Hz – 15kHz) Wien Bridge oscillator*

Thus, if the output amplitude increases, the lamp heats up and increases its resistance, thereby reducing the circuit gain and providing automatic amplitude stabilisation. This circuit also shows how the Wien network can be modified by using a twin-gang pot to make the oscillator frequency variable over the range 150Hz to 1.5kHz, and how the sine-wave output amplitude can be made variable via RV3.

In the *Figure 3 and 4* circuits, the pre-set pot should be adjusted to set the maximum mean output level to about 2V rms, and under this condition the sine-wave has a total harmonic distortion of about 0.1%. Note that a slightly annoying feature of thermistor-stabilised circuits is that, in variable-frequency applications, the output amplitude of the sine-wave tends to judder or 'bounce' as the frequency control pot is swept up and down its range.

Diode-Stabilised Circuits

The amplitude 'bounce' problem of variable-frequency circuits can be minimised by using the basic circuits of *Figures 5 or 6,* which rely on the onset of diode or zener conduction for automatic gain control. In essence, RV2 is set so that the circuit gain is slightly greater than unity when the output is close to zero, causing the circuit to oscillate, but as each half-cycle nears the desired peak value one or other of the diodes starts to conduct and thus reduces the circuit gain, automatically stabilising the peak amplitude of the output signal. This 'limiting' technique typically results in the generation of 1% to 2% distortion on the sine-wave output. The maximum pk-to-pk output of each circuit is roughly double the breakdown voltage of its diode regulator element.

In the *Figure 5* circuit, the diodes start to conduct at 500 mV, so the circuit gives a pk-to-pk output of about 1V0. In the *Figure 6* circuit, zener diodes ZD1 and ZD2 are connected back-to-back, and may have values as high as 5V6, giving a pk-to-pk output of about 12V. Each circuit is set up by adjusting RV2 to the maximum value (minimum distortion) at which oscillation is maintained across the whole frequency band.

The frequency range of all the above circuits can be altered by changing the C1 and C2 values; increasing the values by a decade reduces the frequency values by a decade. *Figure 7* shows the circuit of a variable-frequency Wien oscillator that covers the range 15Hz to 15kHz in three switched decade ranges. The circuit uses zener diode amplitude regulation, and its output is adjustable by both switched and fully-variable attenuators. Note that the maximum useful operating frequency of this type of circuit is restricted by the slew-rate limitations of the op-amp. The limit is about 25kHz with a 741 op-amp, or about 70kHz with a CA3140.

Twin-T Oscillators

Another way of making a sine-wave oscillator is to wire a Twin-T network between the output and input of an inverting op-amp, as shown in *Figure 8.* The Twin-T network comprises R1-R2-R3-RV1 and C1-C2-C3, and in a 'balanced'

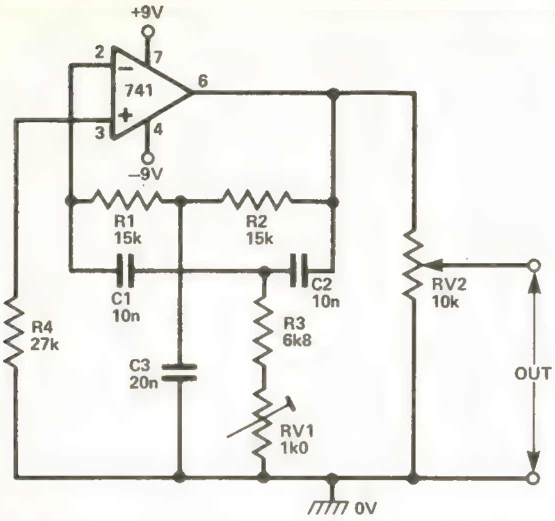

Fig 8 *1kHz Twin-T oscillator*

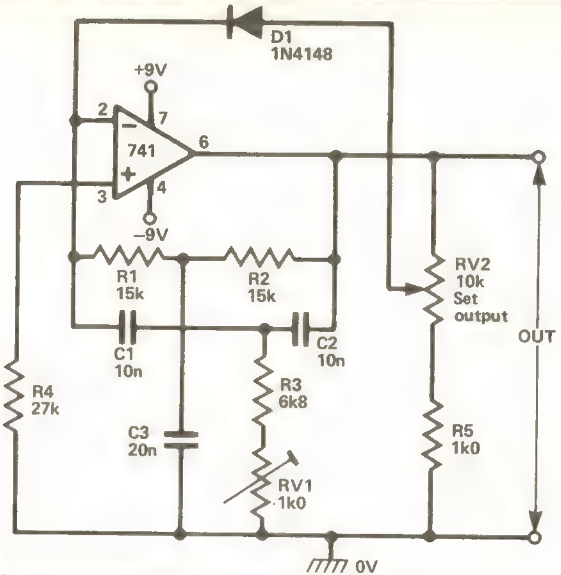

Fig 9 *Diode-regulated 1kHz Twin-T oscillator*

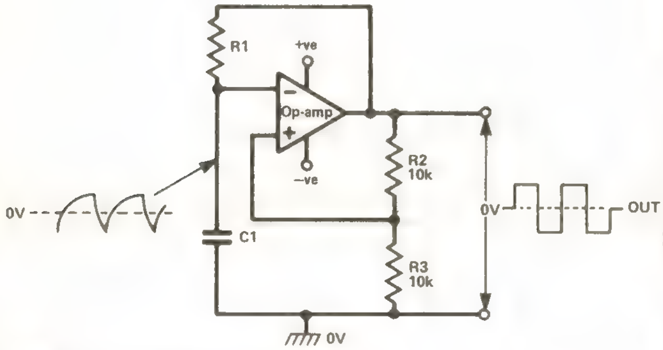

Fig 10 *Basic relaxation oscillator circuit*

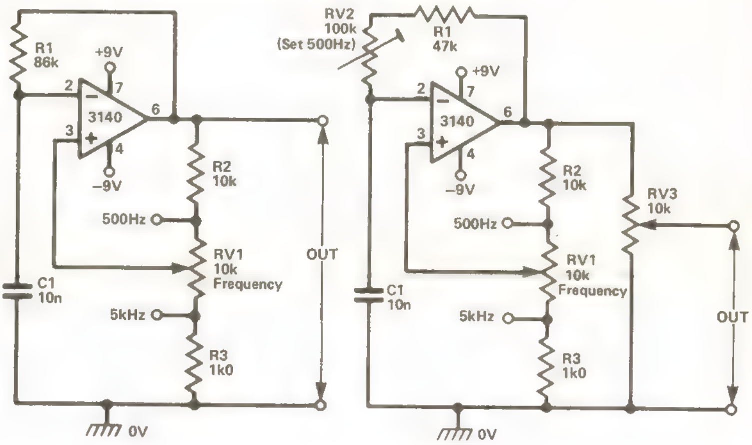

Fig 11 *Simple 500Hz-5kHz square-wave oscillator*

circuit these components are in the ratios R1 = R2 =2(R3+RV1), and C1=C2=C3/2. When the network is perfectly balanced, it acts as a frequency-dependent attenuator that gives zero output at a centre frequency (fo) of 1/6.28xR1xC1, and a finite output at all other frequencies. When the network is imperfectly balanced, it gives a minimal but finite output at fo, and the phase of this output depends on the direction of the imbalance: if the imbalance is caused by (R3+RV1) being too low in value, the output phase is inverted relative to the input.

In *Figure 8*, the Twin-T network is wired between the output and the inverting input of the op-amp, and RV1 is critically adjusted so that the Twin-T gives a small phase-inverted output at fo. Thus, zero overall phase inversion occurs round the feedback loop, and the circuit oscillates at a centre frequency of 1kHz. In practice, RV1 is adjusted so that oscillation is barely sustained, under which condition the sine-wave output has less than 1% distortion. Automatic amplitude control occurs because of the progressive non-linearity of the op-amp as the output signal approaches clipping level. The output amplitude is fully variable from zero to about 5V rms via RV2.

Figure 9 shows an alternative method of amplitude control, which results in slightly less distortion. Here, D1 provides a feedback signal via potential divider RV2. This diode progressively conducts and reduces the circuit gain when the diode forward voltage exceeds 500mV. To set up the circuit, first set RV2 slider to the op-amp output and adjust RV1 so that oscillation is just sustained; under this condition the output signal has an amplitude of about 500 mV pk-pk. RV2 then enables the output signal to be varied between 170mV and 3V0 rms.

Note that the above two Twin-T circuits make good fixed-frequency oscillators, but are not suitable for variable-frequency use, due to the difficulties of varying three or four network components simultaneously.

SQUARE-WAVE GENERATORS

An op-amp can be used to generate square-waves by using the basic relaxation oscillator configuration of *Figure 10*. The circuit uses dual power supplies, and the output switches alternately between the positive and the negative saturation levels of the op-amp. Potential divider R2-R3 feeds a fraction of this voltage back to the non-inverting input of the op-amp, to provide the circuit with an 'aiming' voltage, and feedback components R1-C1 act as a time-constant network.

The basic operation of the *Figure 10* circuit is such that, when the output is high, C1 charges up via R1 until the C1 voltage reaches the positive 'aiming' value set by R2-R3, at which point the op-amp output regeneratively switches negative, causing C1 to start to discharge via R1 until the C1 voltage falls to the negative 'aiming' value set by R2-R3, at which point the op-amp output regeneratively switches positive again, and the whole sequence then repeats ad infinitum. The action is such that a symmetrical square wave is developed at the output of the op-amp, and a non-linear triangle waveform is developed across C1; these waveforms swing symmetrically either side of the zero-volts line. A fast op-amp, such as the CA3140, should be used if good output rise and fall times are needed from the square wave.

Note that the operating frequency of this circuit can be varied by altering either the R1 or C1 values, or by altering the R2-R3 ratios. This circuit is thus quite versatile. *Figure 11* shows how it can be adapted to make a practical 500Hz to 5kHz square-wave generator, with fre-

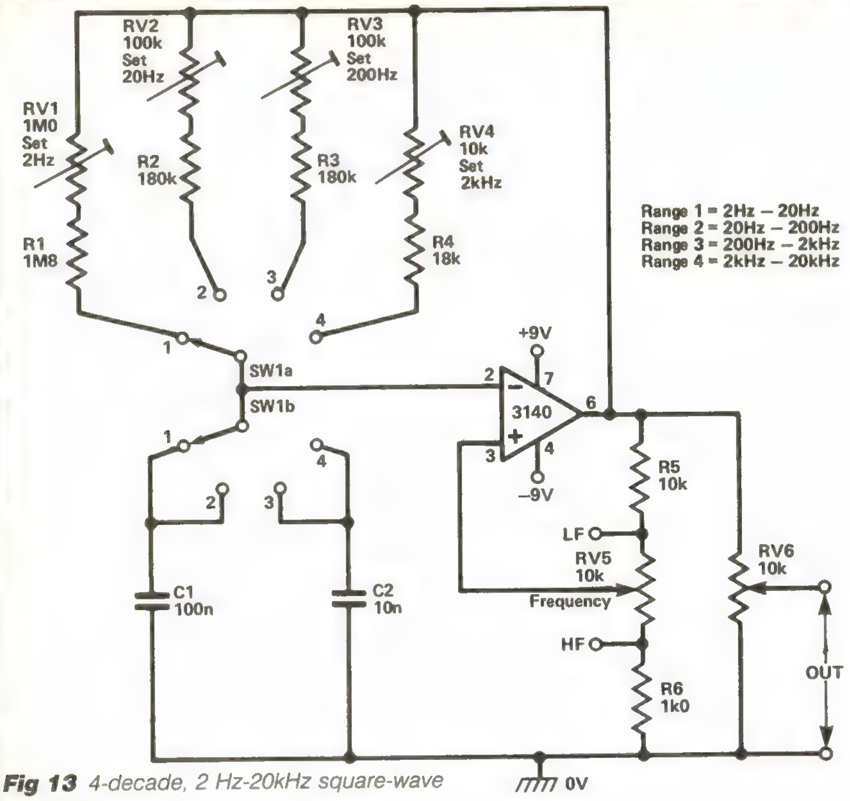

Fig 13 *4-decade, 2 Hz-20kHz square-wave generator*

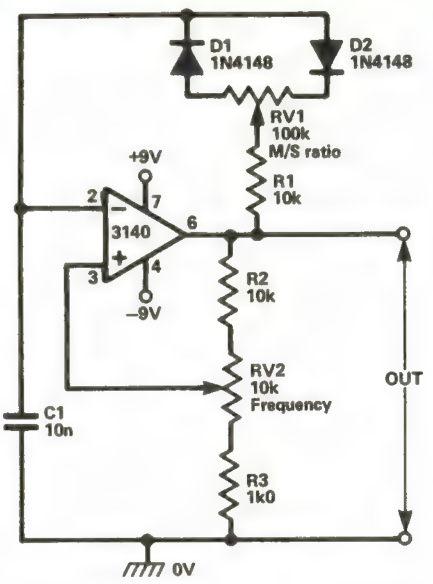

Fig 14 *Square-wave generator with variable M/S ratio and frequency*

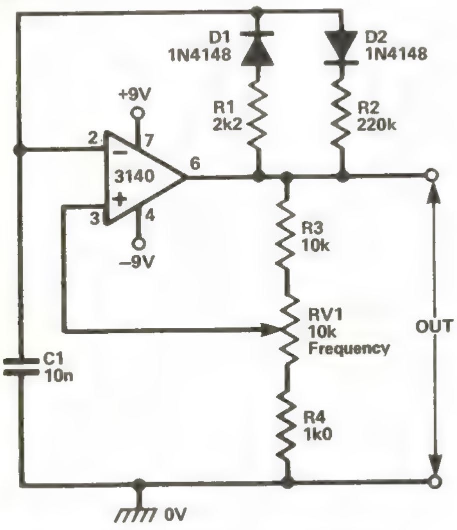

Fig 15 *Variable-frequency narrow-pulse generator*

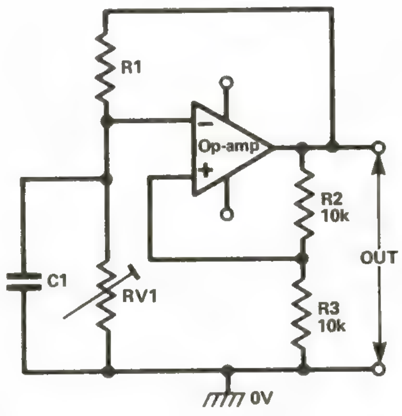

Fig 16 *Basic resistance-activated relaxation oscillator*

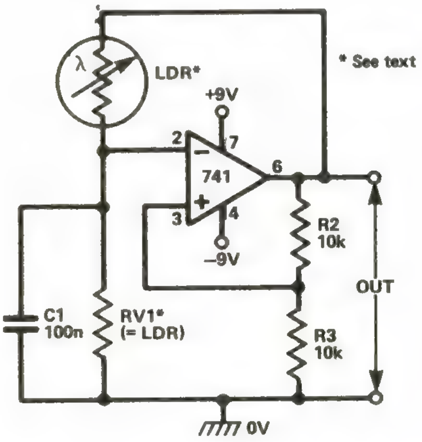

Fig 17 *Precision light-activated oscillator/alarm*

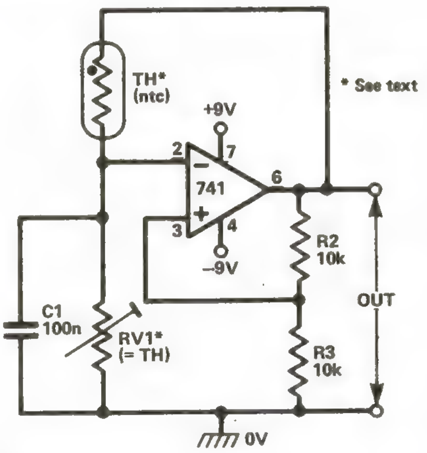

Fig 18 *Precision over-temperature oscillator/alarm*

quency variation obtained by altering the attenuation ratio of R2-RV1-R3. *Figure 12* shows how this circuit can be improved by using RV2 to pre-set the range of the RV1 frequency control, and by using RV3 as an output amplitude control.

Figure 13 shows how the above circuit can be modified to make a general-purpose square-wave generator that covers the 2Hz to 20kHz range in four switched decade ranges. Pre-set pots RV1 to RV4 are used to precisely set the minimum frequency of the 2Hz – 20Hz, 20Hz – 200Hz, 200Hz – 2kHz, and 2kHz – 20kHz ranges respectively.

Variable symmetry

In the *Figure 10* circuit, C1 alternately charges and discharges via R1, and the circuit generates a symmetrical square-wave output. The circuit can easily be modified to give a variable-symmetry output by providing C1 with alternate charge and discharge paths, as shown in *Figures 14 and 15.*

In the *Figure 14* circuit, the MARK/SPACE (M/S) ratio of the output waveform is fully variable from 11:1 to 1:11 via RV1, and the frequency is variable from 650Hz to 6.5kHz via RV2. The circuit action is such that C1 alternately charges up via R1-D1 and the left-hand side of RV1, and discharges via R1-D2 and the right-hand side of RV1, to provide a variable-symmetry output. Note that variation of RV1 has negligible effect on the operating frequency of the circuit.

In the *Figure 15* circuit, the MARK period is determined by C1-D1-R1, and the SPACE period by C1-D2-R2; these periods differ by a factor of one hundred, so the circuit generates a narrow pulse waveform. The pulse frequency is variable from 300Hz to 3kHz via RV1.

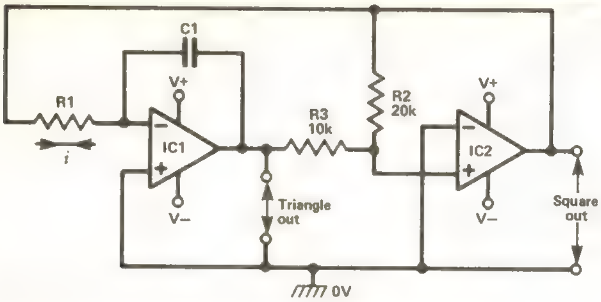

Fig 19 Basic triangle-square function generator

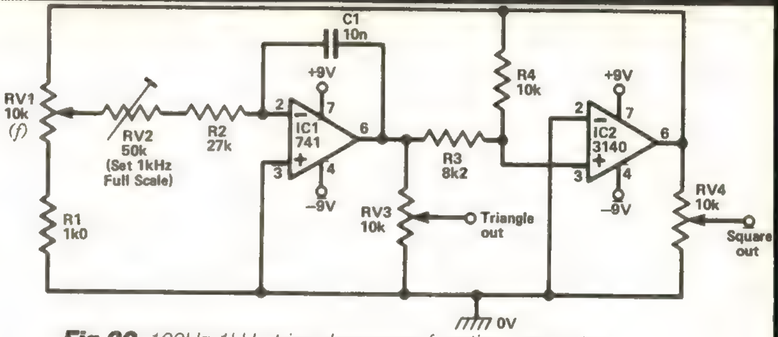

Fig 20 100Hz-1kHz triangle-square function generator

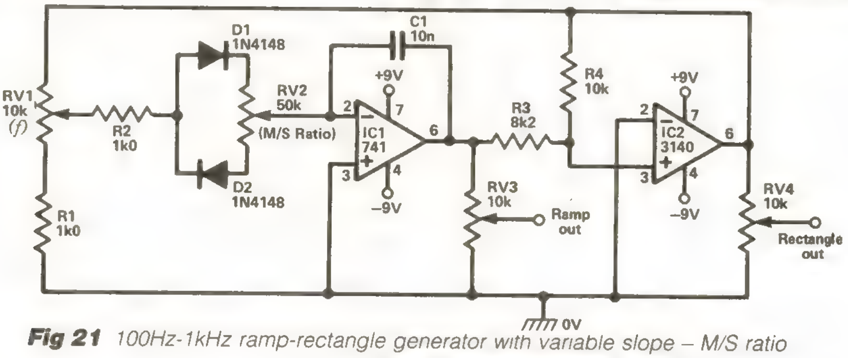

Fig 21 100Hz-1kHz ramp-rectangle generator with variable slope – M/S ratio

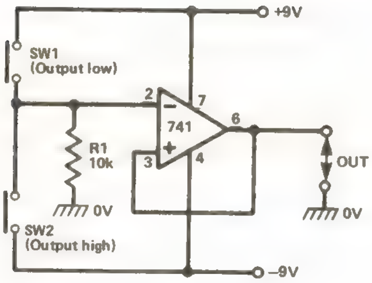

Fig 22 Simple manually-triggered bistable

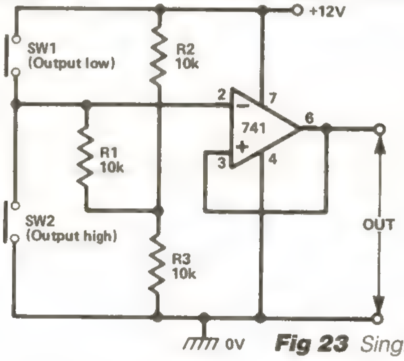

Fig 23 Single-supply manually-triggered bistable

Resistance activation

Note from the description of the *Figure 10* oscillator that the circuit actually changes state in each half-cycle at the point where the C1 voltage reaches the 'aiming' value set by the R2-R3 potential divider. If C1 is unable to attain this voltage, the circuit will not oscillate. Consequently, if the circuit is modified as shown in *Figure 16,* in which RV1 is wired in parallel with C1 and forms a potential divider with R1, and R2-R3 have a 1:1 ratio, the circuit will oscillate only if RV1 has a greater value than R1. This circuit can thus function as a resistance-activated oscillator.

Figures 17 and 18 show two practical applications of the resistance-activated oscillator. The *Figure 17* circuit acts as a precision light-activated oscillator or alarm, and uses an LDR as the resistance-activating element. The circuit can be converted to a 'dark-activated' oscillator by transposing the LDR-RV1 positions. The *Figure 18* circuit is similar to this, but uses negative-temperature-coefficient thermistor TH as the resistance-activating element, and acts as a precision over-temperature oscillator/alarm. The circuit can be converted to an 'under-temperature' oscillator by transposing TH and RV1.

In the above two circuits, the LDR or TH can have any resistance in the range 2k0 to 2M0 at the required trigger level, and RV1 must have the same value as the activating element at the desired trigger level. RV1 sets the trigger level; the C1 value can be altered to change the oscillator frequency.

TRIANGLE-SQUARE GENERATION

Figure 19 shows the basic circuit of a function generator that simultaneously generates a linear triangle and a square waveform, using two op-amps. IC1 is wired as an integrator, driven from the output of IC2, and IC2 is wired as a differential voltage comparator, driven from the output of IC1 via potential divider R2-R3, which is connected between the outputs of IC1 and IC2. The square-wave output of IC2 switches alternately between positive and negative saturation. The circuit functions as follows.

Suppose, initially, that the output of IC1 is positive and the output of IC2 has just switched to positive saturation. The inverting input of IC1 is a virtual earth point, so a current (i) of +Vsat/R1 flows into R1, causing the output of IC1 to start to swing down linearly at a rate of i/C1 volts per second. This output is fed, via the R2-R3 divider, to the non-inverting input of IC2, which has its inverting terminal referenced directly to ground.

Consequently, the output of IC1 swings linearly to a negative value until the R2-R3 junction voltage falls to zero, at which point IC2 enters a regenerative switching phase, in which its output abruptly switches to negative saturation. This reverses the inputs of IC1 and IC2, so IC1 output starts to rise linearly, until it reaches a positive value at which the R2-R3 junction voltage reaches the zero volts reference value, initiating another switching action. The whole process then repeats ad infinitum.

Important points to note about the *Figure 19* circuit are that the pk-pk amplitude of the linear triangle waveform is controlled by the R2-R3 ratio, and that the operating frequency of the circuit can be altered by changing either the ratios of R2-R3, the values of R1 or C1, or by feeding R1 from a potential divider connected to the output of IC2 (rather than directly from IC2 output). *Figure 20* shows the practical circuit of a variable-frequency triangle/square generator that uses the latter technique.

In *Figure 20,* the input current to C1 (obtained from RV2-R2) can be varied over a 10:1 range via RV1, enabling the frequency to be varied from 100Hz to 1kHz; RV2 enables the full-scale frequency to be set to precisely 1kHz. The amplitude of the linear triangle output waveform is fully variable via RV3, and of the square-wave via RV4.

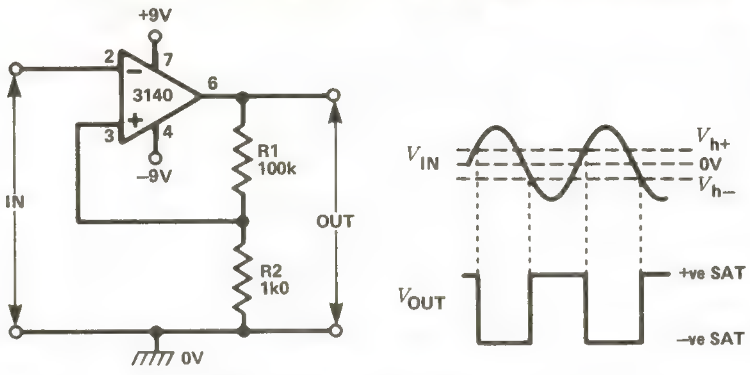

Fig 24 *Schmitt trigger*

The *Figure 20* circuit generates symmetrical output waveforms, since C1 alternately charges and discharges at equal current values (determined by RV2-R2, etc). *Figure 21* shows how the circuit can be modified to make a variable-symmetry ramp – rectangle generator, in which the slope of the ramp and the M/S ratio of the rectangle is variable via RV2. C1 alternately charges via R2-D1 and the upper half of RV2, and discharges via R2-D2 and the lower half of RV2.

SWITCHING CIRCUITS

To conclude this edition of 'Data File', *Figures 22 to 24* show three ways of using op-amps as simple regenerative switches. *Figure 22* shows the connections for making a simple manually-triggered bistable circuit. Note here that the inverting terminal of the op-amp is tied to ground via R1, and the non-inverting terminal is tied directly to the output. The circuit operates as follows.

Normally, SW1 and SW2 are open. If SW1 is briefly closed, the op-amp inverting terminal is momentarily pulled high and the output is driven to negative saturation; consequently, when SW1 is released again, the inverting terminal returns to zero volts but the output and the non-inverting terminal remain in negative saturation. The output remains in this state until SW2 is briefly closed, at which point the op-amp output switches to positive saturation, and locks into this state until SW1 is again operated. The circuit thus gives a bistable form of operation. *Figure 23* shows how the circuit can be modified for operation from a single-ended power supply; in this case the inverting terminal of the op-amp is biased to half-supply volts via R1 and the R2-R3 potential divider.

Finally, *Figure 24* shows how to connect an op-amp as a Schmitt trigger, which can, for example, be used to convert a sine-wave input into a square-wave output. The circuit operates as follows.

Suppose initially that the op-amp output is at a positive saturation value of 8V0. Under this condition the R1-R2 divider feeds a positive reference voltage of 8V0 x (R1+R2)/R2 (= about 80mV in this case) to the non-inverting pin of the op-amp. Consequently, the output remains in this state until the input rises to a value equal to this voltage, at which point the op-amp output switches regeneratively to a negative saturation level of -8V0, feeding a reference voltage of minus 80mV to the non-inverting input. The output then remains in this state until the input signal falls to -80mV, at which point the op-amp output switches regeneratively back to the positive saturation level. The switching levels can be altered by changing the R1 value.

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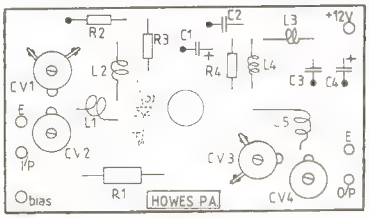

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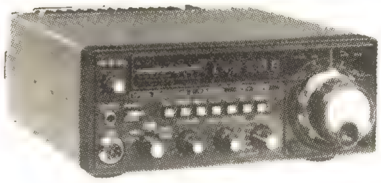

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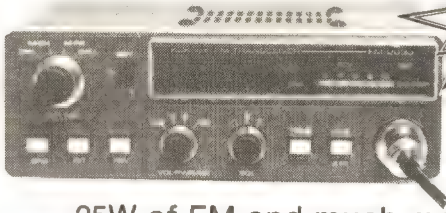

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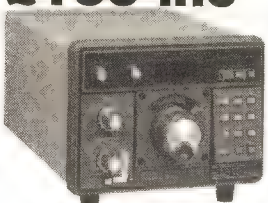

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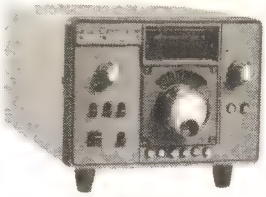

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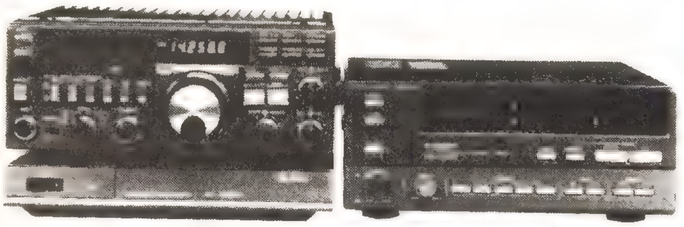

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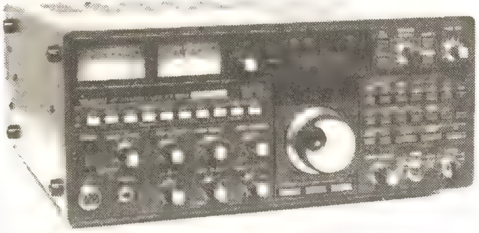

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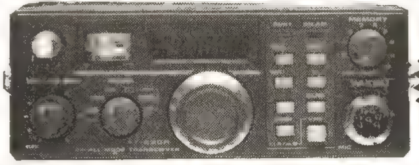

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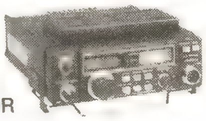

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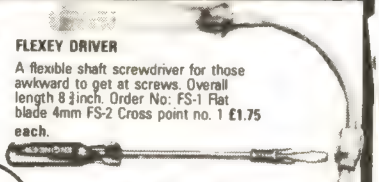

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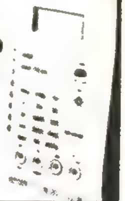

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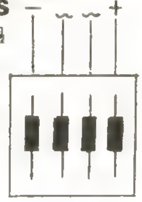

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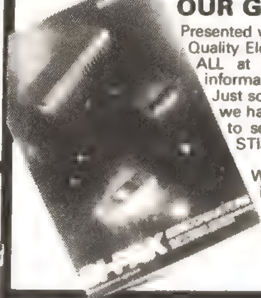

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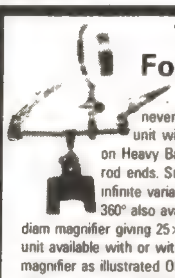

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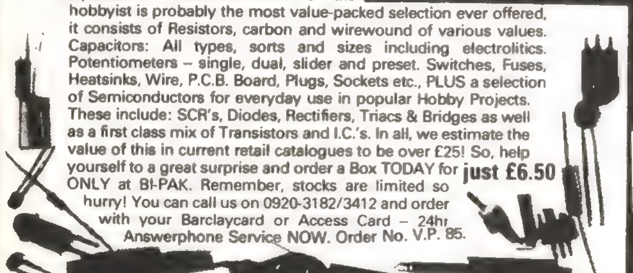

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Six Antennas from Three Wires

by Fred Hopengarten, K1VR and Bob Clarke, N1RC

With these modified Beverage antennas, you double your directions without doubling your cost

An old antenna

First described in a 1922 article by H. H. Beverage, (see ref 1) the Beverage is a receiving antenna described by one friend as an antenna that works poorly in general, but less poorly in one direction. Its principal advantages are:

- It increases your received signal-to-noise ratio (reduces QRN) for low-angle signals (i.e., DX!)
- It has a narrower beamwidth than typical 80-metre antennas. Belrose VE2CV has described the azimuthal beamwidth as 77 degrees. (see ref 2).
- It is much less susceptible to precipitation static, so that a snowstorm in February is less likely to shut down low-frequency operations.
- It is capable of excellent front-to-side performance to reject all that static coming from around the equator.
- It reduces the need for inserting attenuation to protect the solid-state front end of your receiver or transceiver.
- It is not unusual to see 20-25 dB front-to-back thus exhibiting advantages when more powerful stations are located in adverse directions to the installation.

A Beverage is a single-wire antenna used in receiving only. It is end-fed, ½ to 4 wavelengths long, strung horizontally from 6 to 15 feet above ground. Many Beverages are fed at one end, left open-circuited at the other, far end, and are bi-directional in line with the wire (*see Figure 1*). Adding a terminating resistor to the far end, as in *Figure 2*, makes the Beverage unidirectional, but you can't switch directions. Some Beverage users use a dc relay and switch the terminating resistor in and out, but this still does not provide unidirectional performance in each direction. (see refs 4, 5, 6, 7).

However, if you go one step further – feed both ends of a Beverage, select either feedline and terminate the other – you can indeed have two directions from a single wire. This is what we have done, not with just one wire, but three, for six directions!

A new construction

The form of construction described in this article is desirable because few of us live on a piece of land large enough to stretch out a Beverage in each desired direction. But if you can have one wire, you can have *two* directions!

The system has the following components: a control head in the shack, three Beverages, six feedlines, and six 'Beverage Boxes'.

The control head has two switches: A Beverages/transmit antenna switch (to select the transmit antenna to listen on, if desired), and a rotary switch for selecting a favoured direction.

Outdoors, we used three Beverages, which we strung between trees, but more or fewer can be used. Each end of each Beverage wire is connected through a Beverage Box to one of the feedlines.

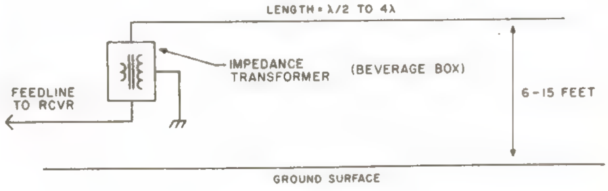

Fig 1 *A basic Beverage antenna. The directivity pattern is bi-directional along the axis of the horizontal wire. The Beverage box contains a transformer which matches the impedance of the antenna to the impedance of the feedline*

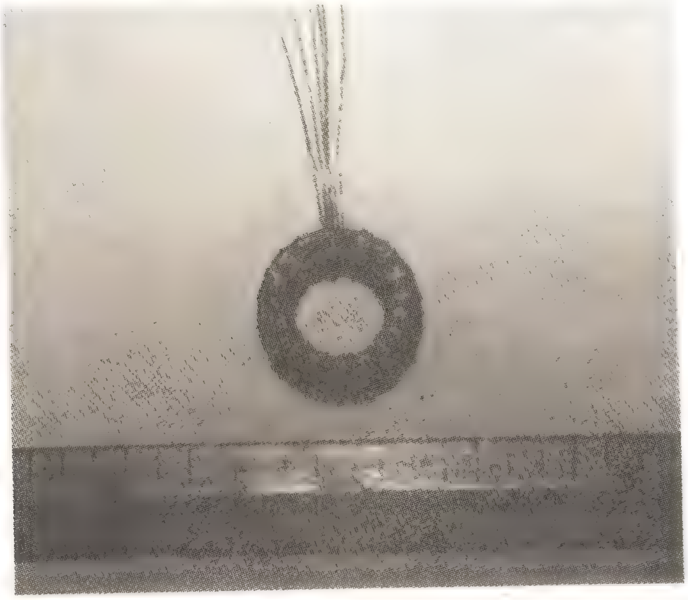

Photo 1 *A view of toroidal matching transformer, showing method of winding*

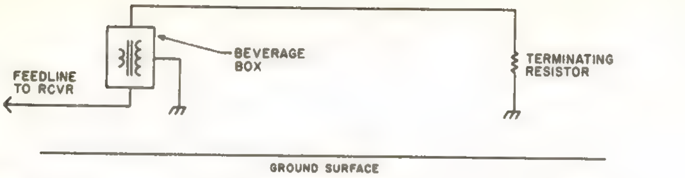

Fig 2 *A terminated Beverage is uni directional towards the terminated end of the antenna. The resistor is a non-inductive type, and experience suggests a value between 300 and 800 ohms*

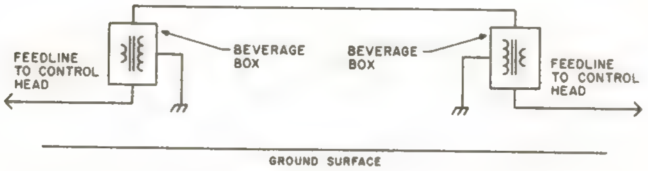

Fig 3 *The directivity pattern of the K1VR/N1RC Beverage is reversible. A control head at the operating position selects one of the two feedlines and routes it to the receiver while terminating the second feedline with a resistance. The antenna is directional towards the end with the terminated feedline. By using three such antennas and a rotary switch six different directions can be selected*

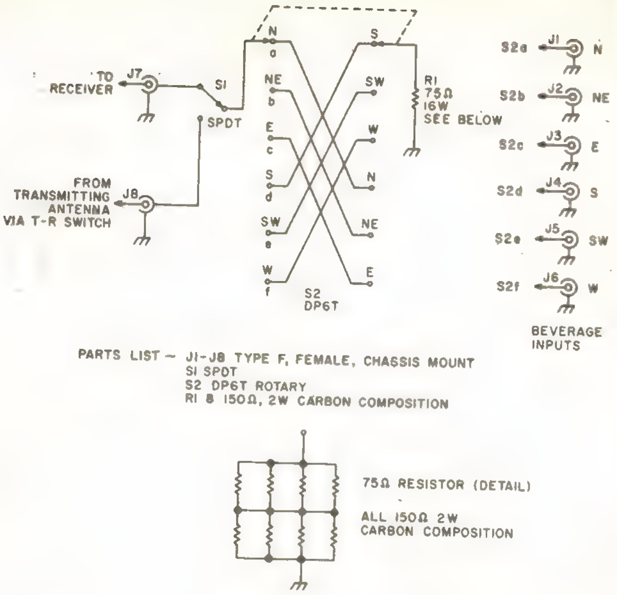

Fig 4 *Control-head schematic diagram*

See *Figure 3*. All feedlines end in the shack at the control head. Our Beverages range from 220 to 325 feet long, limited by the size of K1VR's yard.

It sounds simple because it is simple. Results: improved signal-to-noise, front-to-back, and front-to-side operation when compared with dipoles and delta loops. And you thought you couldn't rotate an 80-metre antenna!

The control head

In the original control head, the transmitting antenna was assigned position number 1 on the rotary switch. With a little experience, however, we soon learned that comparing reception on the Beverage to reception on the transmitting antenna was much easier with a separate toggle switch. In addition, the rotary switch had a nice even number of positions, with no empty space opposite the transmitting antenna.

The double-pole, six-throw (DP6T) rotary switch we used was the type that lets you select the number of positions desired by successively removing stops. We 'crosswired' the switch as shown in *Figure 4*, so that when one feedline is selected, the feedline coming from the opposite end of the same Beverage is connected to the 75-ohm terminating resistor. Thus, if we select, say, the northeast end of Beverage A, then the south-west end of Beverage A is terminated.

Pay close attention to the wiring and labelling, or you will surely have to rewire several times, as we did, to make the switch go nicely around the compass, terminating the other end of the direction selected.

In locating the control head at the operating position, remember that while you may change bands only two or three times per hour at most, you will change directions for receiving repeatedly. So choose a location near the transceiver dial or antenna rotator, to be used by the hand you do *not* write with. The control head should also be plainly visible, so that you won't strain to hear someone only because you've forgotten to 'point' the right antenna at him (or her!).

We used F connectors because they are cheap, readily available, take up much less back panel space than UHF connectors, and are much, much easier to install (a single ⅝ in hole)! BNC connectors would also be appropriate. But note it is a good idea not to use a connector which may also be used in a transmitting application in your shack. Remember, Beverage antennas are for receiving only!

Finally, as we got around to attaching feedlines, it became apparent that as soon as they were identified, it was important to label them with Brady markers, tie-wrap tabs, or even masking tape to indicate direction. Without marking, eight identical RG-59 ends with F connectors quickly became confusing.

The jumper connecting the control head to the transceiver at K1VR was RG-59 with an F connector on one end and an RCA phono plug on the other. Note that a small modification may be necessary to your transceiver to permit operation with a separate receiving antenna while maintaining the flexibility of switching back to the transmit antenna for receiving, if desired.

Feedline

Of course, the magic in the design of these antennas is that the feedlines are so inexpensive. With the advent of cable TV, so-called 'drop cable' has become widely available at very attractive prices. This is the cable which is run from the telephone pole on the street to the home.

Drop cable comes in two sizes:RG-59 and RG-6. At 5MHz, RG-59 has an attenuation of approximately 0.55 dB/100 feet; RG-6, which is more expensive, is approximately 0.45 dB/100 feet (source: Belden catalogue). Therefore, since loss is inconsequential (the more feedline loss, the less attenuation you will have to insert to prevent front-end overload), choose the line on which you get the best deal. However, other considerations may contribute to your decision.

If you live near a strong local station or intend to operate in the multi-operator/multi-transmitter category in various contests, you may wish to consider the question of shielding. RG-59 is commonly available in 40% braid/100% foil or 60% braid/100% foil. The more ingress of signal that you expect, the more you should consider using 60% braid or even 95% braid. *In extremis*, these cables are also available with double shielding and double foil. Double-braided RG-6 is the choice for direct burial installations.

In any ham station, the question of splicing wire often arises. A few words of advice are appropriate. If you have to put a cable in conduit to get out of your house and into the backyard, *never* put a splice inside the conduit. If you must splice outdoors, splicing and then putting the splice underground is bad business, as it is just too susceptible to water getting into the coax. Since this is a foam coax, the water will migrate without mercy. The coax is cheap: if you value your time at all, use unbroken runs of coax in conduit and underground!

Finally, when working with cable-TV coax, remember that the braid is generally going to be made of aluminium and will not solder. This dictates that all connectors must be either crimp-on BNC or crimp-on F. As for the crimping, it may be awkward, but be sure to borrow or buy the correct crimping tool. Merely using a pair of pliers will not do the kind of rf-tight crimp which will last.

BEVERAGE BOXES (THE TERMINATIONS)

The Beverage Box is the interface between one end of a Beverage antenna and its 75-ohm transmission line. It

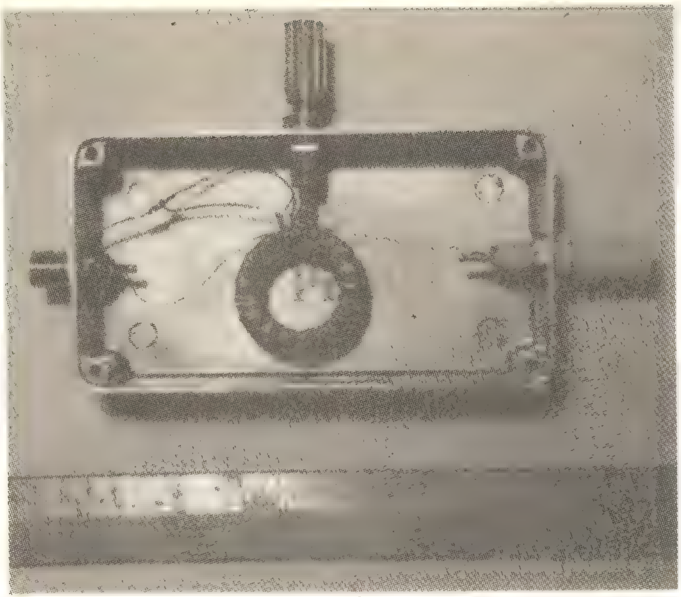

Photo 2 *Inside view of a Beverage Box*

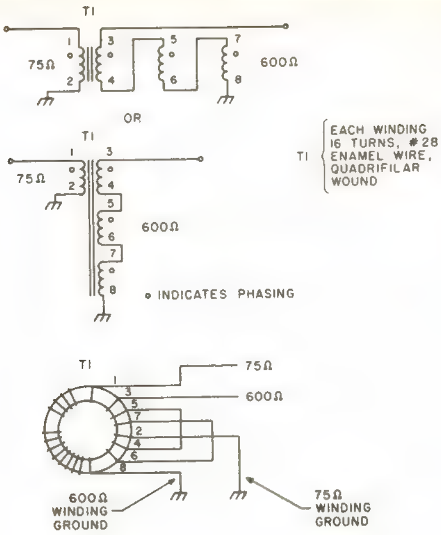

Fig 5 *Transformer winding details*

and its 75-ohm transmission line. It should have minimum insertion loss, operate efficiently over a wide frequency range, and be weatherproof.

As a starting point, we knew that, according to the literature, Beverage impedances could range from 400 to 800 ohms or so, but that we could reasonably expect an impedance in the 500-600 ohm range. Furthermore, we decided that rather than design a multiple-impedance matching transformer, a single 600-ohm-to-75-ohm design would be used. The thought of many treks into the woods to adjust taps aided in this decision!

The actual construction of the box was divided into smaller units of decision-making.

Connectors

F connectors were selected for the very same reasons we used them in the control head.

Also, watertight boots which go over F connectors are readily available. Filling them with silicone grease (not caulk) before tightening will make a very good setup. Remember to put the boot on before putting on the F connector. The authors have forgotten this rule more than once.

Binding Posts

We selected commonly-available posts and have very little to contribute to the discussion. However, it is a good idea to get the type with a hole through the post to ensure a good contact even after oxidation has begun. Also, note that some binding posts (the cheapest type) are not feedthrough types. That is, they are not insulated from the surface in which they are mounted. These should be avoided.

The Transformer

The transformer design meets the following criteria:

Impedance

Ratio (Ohms)	6.00:75 (8:1)
Bandwidth	1.0 to 30MHz
Insertion loss	negligible

The transformer was quadrifilar wound (*Figure 5*), one winding serving as the 75-ohm secondary, the other windings connected in series as the 600-ohm primary. All windings were 16 turns, #0.28 enamel wire, close-wound (*Photo 1*), on an Indiana General 626-12-Q1 core (available from Permag Northeast Corp., 10 Fortune Drive, Billerica MA 01865; (617) 273 2890). Each winding had a self-impedance of 375 ohms (5 x 75). The core of the transformer had a 0.75in inner diameter, a 1.25in outer diameter, and a 0.375in width.

Note that the late Jim Lawson W2PV found that in the presence of very high rf levels – a local AM radio station – the toroid core saturated. He used L/C networks for transformers instead of toroids at his location.

Both a network analyzer and an rf-vector impedance metre (75-ohm impedance) were used to verify transformer performances. Test setups are shown in *Figures 6 and 7*; measurements are listed in Tables 1 and 2. Measurements made using the network analyzer are return loss as measured in decibels. Return loss is the relation between the power returning down the line from a mismatched load to the power incident to that load'. (Stephen F. Adam, *Microwave Theory and Applications*, Prentice Hall, 1969.) It is related to vswr by the formula: $R1 = -20 \log_{10}$ (vswr - 1/vswr + 1). Equivalent vswr's are included in Table 2.

All measurements were made with the transformer terminated in a 600-ohm load consisting of two 1200-ohm, quarter-Watt, carbon composition resistors in parallel.

N1RC also tried a measurement setup which the average ham can do at home to get a rough indication of Beverage performance. Although the transformer is designed for a 600-ohm-to-75-ohm impedance transformation (an 8:1 ratio), it can also be used for 400-ohm-to-50-ohm applications. Bob made a 400-ohm dummy load of 8-50-ohm, 10-Watt wire-wound resistors and connected it to the 600-ohm side of the transformer. After connecting the 75-ohm side to the 'Antenna' connector of a vswr bridge and

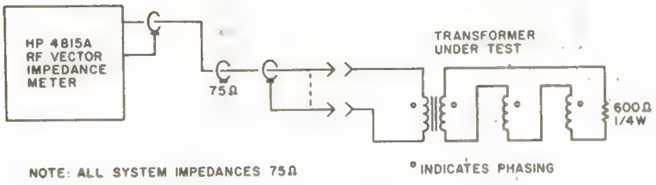
HP 4815A RF VECTOR IMPEDANCE METER
75Ω
TRANSFORMER UNDER TEST
600Ω 1/4W
NOTE: ALL SYSTEM IMPEDANCES 75Ω
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Fig 6 *Impedance-measurement test set-up*

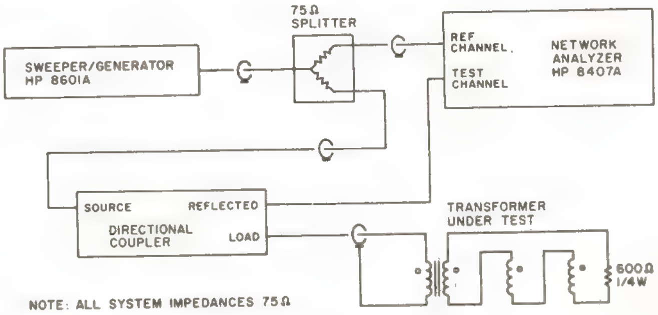

Fig 7 *Transformer return-loss test set-up*

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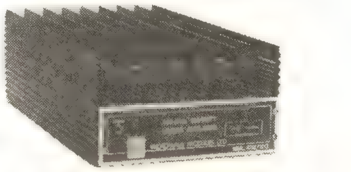
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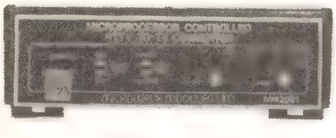
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applying enough power to get a full-scale deflection, he measured the vswr (quickly!) on 160, 80, and 40 metres. It was 1.5, 2, and 3, respectively, and into a reactive load.

Winding Tips

Leave about three inches of wire free on each end of each winding. Tin each end for about ¼in, remove the enamel by burning it off with a hot soldering iron. Wipe the tip of the iron frequently on a wet sponge to clean it. When all eight ends are tinned, identify each winding using a continuity tester or VOM. Separate out one winding as the 75-ohm winding. Carefully solder the other three windings in series, removing excess wire (you don't need six inches), and re-tin ends before connecting the two end windings to the centre windings. Pay careful attention to polarity (phasing).

Box assembly

Each transformer is mounted in the Beverage Box on a platform built up of clear uncured RTV. When this cures, the toroid will be held securely in place. The ground ends of the windings are connected together to the ground binding post and a chassis ground. The 75-ohm and 600-ohm windings are connected to the F connector and input binding post, respectively (*see Photo 2*). Be careful not to reverse these connections as we did in one box. If you need to identify windings, disconnect the ground ends from ground and from each other. The 600-ohm winding will then show continuity from the 'hot' end to the connections between its centre winding and outer windings.

Another consideration is the location of the 600-ohm binding post, the 75-ohm binding post, and the F connector. We placed the 600-ohm binding post and the F connector on opposite ends of the long axis of the Beverage Box with the ground binding post placed on the side. In this way, the box could be 'hung' from a Beverage. The F connector and 75-ohm feedline hang vertically from the bottom of the box with no right angle bends in the cable and a natural drip path for the water off the box.

The box

We chose an aluminium Hammond 1590 B box (109 x 58 x 25 mm), equivalent to Bud box number CU 124, because it was reasonably priced – in the $6.00 area – and had an inner lip which protects the circuitry from the weather. All seams in the box and connectors were coated with clear nail polish to form an inexpensive and watertight seal. *Photo 3* shows a completed box.

F(MHz)	Z(Ohms)	θ °
1.8	70	+ 6
2.0	70	+ 6
3.5	70	0
4.0	71	0
7.0	68	+ 2
7.3	67	+ 2
14.0	56	– 2
14.35	54	– 4
21.0	42	+ 8
21.5	42	+ 9
28.0	38	+30
28.5	37	+37

Table 1. Transformer vector-impedance measurements

Photo 3 *Assembled and sealed Beverage Box. The system of three reversible Beverages at K1VR required six of these boxes*

Grounding

This is a subject all its own. But it is probably worth a few words here. The Beverage antenna will be erected only 8-15 feet off the ground. Therefore, it is unlikely to receive a direct hit from lightning.

To a certain extent, the feedlines to the Beverage Boxes act as counterpoises, since the most convenient route from the shack to the Beverage Boxes furthest from the shack was almost always along the ground beneath the Beverages. All feedline braids were grounded at each end. However, this counterpoise effect caused by the feedlines is not a designed-in part of the Beverage system and cannot be depended upon to either improve or degrade system performance. It just must be accepted as one result of this design.

In the installation of this antenna, several four-foot cable-TV ground rods were used. In addition, several six-and eight-foot ground rods were used. Six-foot-by-⅜in or eight-foot-by-⅝in ground rods seem to be the grounding system of choice. But the best strategy seems to be this: Erect something, and if you are unsatisfied with performance, go out and add more ground rods a few feet away or add radials to the existing ground rod.

F(MHz)	Return Loss (dB)	Vswr
1	20	1.22
2	30	1.06
2.7*	45	1.01
3	35	1.04
4	30	1.06
5	28	1.08
6	25	1.12
7	22	1.17
8	20	1.22
9	19	1.25
10	18	1.28
11	17	1.34
12	16	1.38
13	16	1.38
14	16	1.38
15-30	>10	<1.9

*Resonance in transformer produced (out of ham band) measurement anomaly.

Table 2: Transformer return-loss measurements.

Incidentally, since number 6 copper ground wire was available, we simply used two strands of number 12 (approximately equivalent to one number 9 wire) to ground the termination boxes.

Place the ground rod a few feet away from the tree and you will have a better chance of avoiding thick roots when you drive the rod(s) into the ground.

Note that a six-direction Beverage system uses seven ground rods; the last one is for ground back at the shack. But you have already installed a good ground for your station, haven't you?

Wire and height

Beverages will work best, it seems, at heights from 6 to 15 feet. Above that, they begin to look like conventional longwires. We caution you to put the wire up at least 10 feet, however, because one Massachusetts ham is now the defendant in a lawsuit resulting from a trespasser on horseback who was toppled from her horse when she hit the Beverage wire.

At K1VR, due to constraints imposed by lot size, the Beverages were only between 220 and 325 feet long. Widely-circulated folklore suggests that two wavelengths, or 450 feet at 80 metres, is optimum. There is some experience, at W4BVV and W1ZA, to suggest that 1000-1200 feet is too long at 80 metres. Almost any wire will do but we recommend stranded and insulated, approximately number 16 or number 18 AWG. Finally, if you want the wire to be seen, because you cross an open field perhaps, make it white or yellow. On the other hand, if you live in a more suburban area and wish to hide it a bit, choose green, brown, or black insulation.

The best mounting method yet discovered is to use standard electric fence wire standoff insulators made of plastic. They can be hammered into a tree in seconds.

Remember, when installing your wire, to keep it as far away as possible from towers and other metallic structures which may have the undesired effect of capacitive coupling. In the case where a 300-foot wire is supported in the middle by your tower, it is more likely to behave as if it were a 150-foot wire.

We chose stranded wire because, over such long runs, supported by trees, a solid wire would be flexed frequently, leading to stretching and breakage.

Conclusions

We set out to make a unidirectional receiving antenna for the low bands which would be very good for DX and reject signals from the side and back. For a modest amount of work, on a plot of modest size, we attained that goal.

Once we had the antennas up and working, we did notice something about their operation that deserved a bit of attention. Occasionally a signal seemed to peak on the wrong antenna. There are two reasons that this can occur. For one, a particular Beverage may not so much favour one direction as it nulls the interference coming from another. This gives the *appearance* of peaking a signal on the wrong antenna. In trying conditions, this means that some judicious switching is worthwhile. For another, Beverages are essentially low-angle antenna. As a result, a close (0-300 miles) station may actually be louder on the high-angle side lobe of a completely different direction Beverage than on the Beverage favouring that direction. At K1VR, this means that K2s often peak north or northeast. Locals, it seems can peak almost anywhere.

Having established that we had a working antenna system and knowing full well that nothing good ever lasts, we decided to make records of baseline resistance measurements at the control head. There is variation due to feedline lengths, and maybe even grounding, but by measuring between the centre conductor and ground at the output of the control head (removing the jumper that goes to the receiver), lines measured between 6 and 40 ohms.

It is really neat to peak up the weak ones and reject the strong ones by changing directions so easily. If you've long bemoaned the noise and crud on 40, 80, and 160, try a Beverage and double your fun by feeding both ends!

Acknowledgments

This interesting adaptation of Beverage aerials appeared in the October 83 issue of '73 Magazine' and we thank the publishers for permission to reproduce it for our readers.

Thanks to W1CF who erected the prototype version on Martha's Vineyard. And thanks to W1FC who took the first cut at designing the transformer. Both men work at M/A-COM, where we used some lab instruments for testing. Thanks also to N1BC for some helpful hints. K1VR thanks his company, Channel One, for offering a good deal on some RG-59 left over from satellite cable-TV installations.

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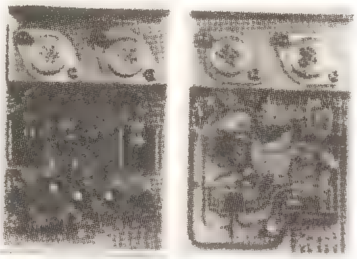

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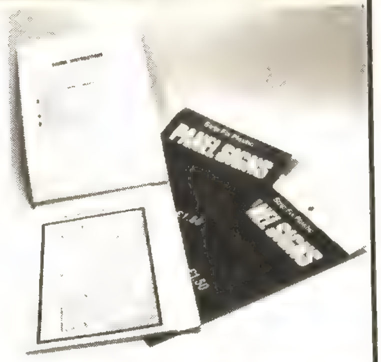

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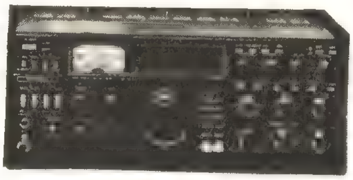

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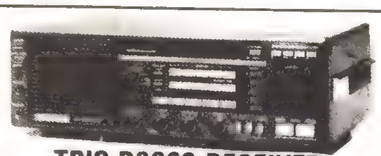

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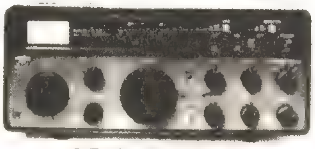

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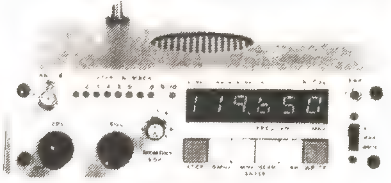

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Number of channels. 1040 (25KHz steps).

Sensitivity: Better than 0.75 microvolts 10dB /SN.

Memory channels: 100 (10 banks of 10). Memories can be scanned automatically or selected manually.

Power required: 12V dc negative earth 300mA typical. (Display can be switched off to reduce consumption when operating portable) Size: 160 x 45 x 130mm.

Weight: approx. 1Kg. (including memory backup batteries).

A Switched Step Attenuator with help from a TRS-80

by Tony Bailey G3WPO

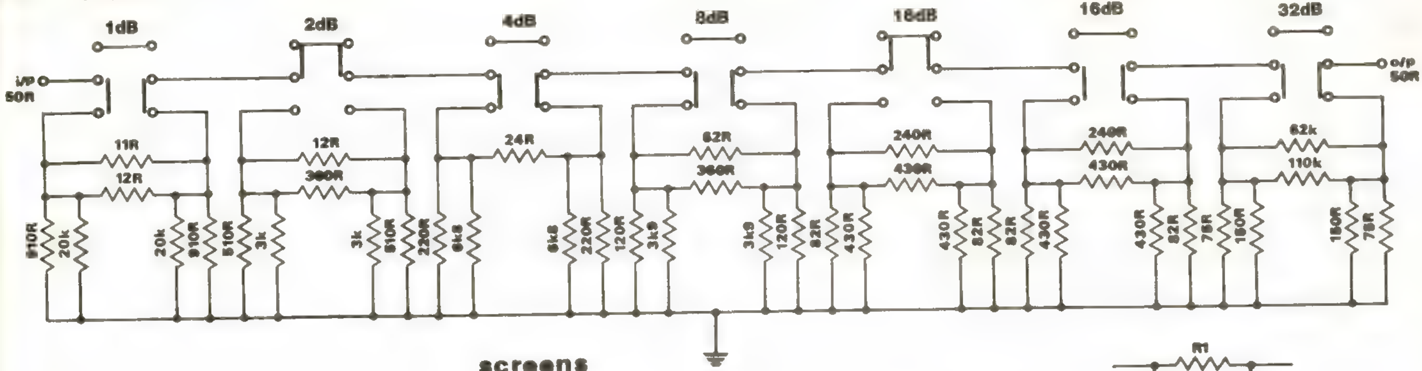
This article describes the construction of a switched attenuator which is useful for putting ahead of receivers to reduce cross modulation effects, and can be placed at the input and output of test equipment to reduce the signal by a given number of dB. It has a constant impedance input/output of 50 or 75 ohms and is usable from DC to 30MHz.

Strange value resistors

Anyone who has had occasion to build test equipment that has required an attenuator in specific dB steps has probably come up against the problem of needing resistors with strange values such as 79.2 ohms or 39.6k etc. Unfortunately these values are required for accurate attenuators especially where you are trying to match into 50 or 75 ohm loads. There may be other occasions when this type of resistor is required.

Even if you can get hold of them, these resistors are expensive. An easy way to get the value you require is to connect a number of values in series or parallel until the value wanted is obtained. The series method is probably the most commonly used, but you tend to need a lot of resistors and the tolerances do not always cancel out as you might hope. A better way is to use the parallel method, as with 2 resistors from the E24 series it is possible to get within 1 or 2% of any value you might require using 1% metox resistors.

If you haven't met the E24 series then the set of values you probably are familiar with is the E12 series where the



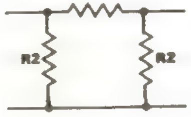


Fig 1 *Diagram of attenuator values for 50Ω impedance*

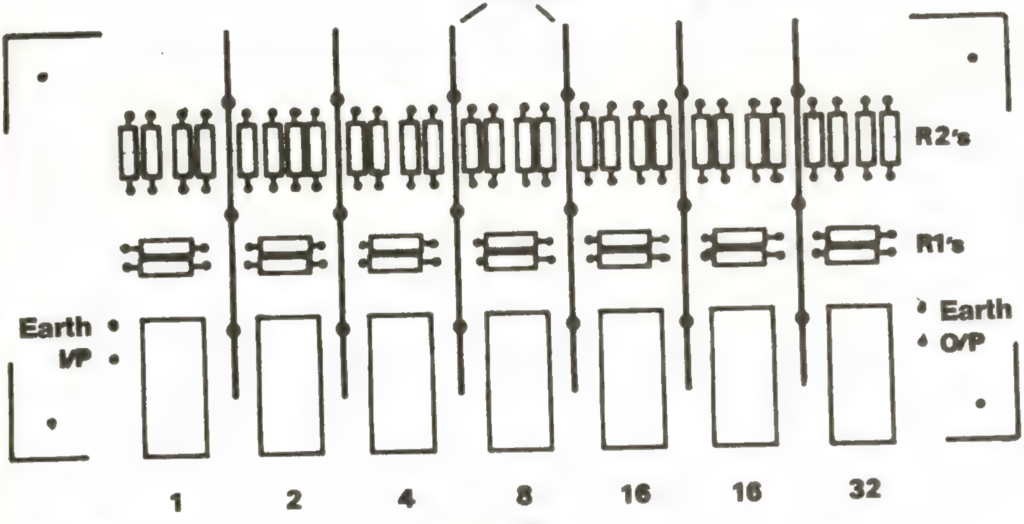


Fig 2 *PCB layout*

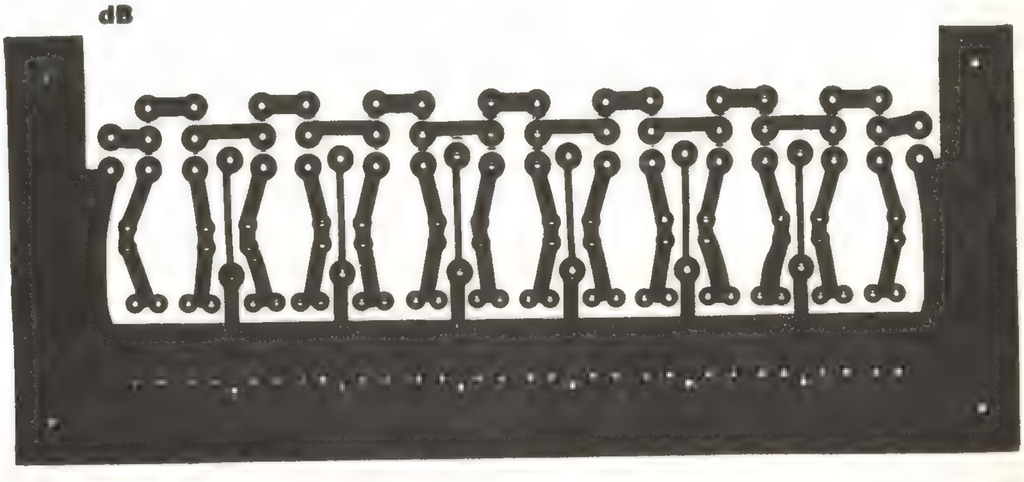


Fig 3 *PCB foil pattern*

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R1	4·0284	8·0569	12·0854	14·9916	18·1281	44·9750
R2	4·0291	8·0583	12·0875	14·9944	18·1312	44·9833
R3	4·0298	8·0597	12·0895	14·9972	18·1343	44·9916
R4	4·0305	8·0611	12·0916	15·0000	18·1375	45·0000
R5	4·0319	8·0638	12·0958	15·0055	18·1437	45·0166
R7	4·0326	8·0652	12·0979	15·0083	18·1468	45·0250
S8	—	—	12·1000	14·9444	18·1500	44·8333*
S9	—	—	12·1020	14·9472	18·1531	44·8416*
S10	—	—	12·1041	14·9500	18·1562	44·8500*
S11	4·0354	8·0708	12·1062	14·9572	18·1593	44·8583
S12	—	—	12·1083	14·9555	18·1625	44·8666*
S13	—	—	12·1104	14·9583	18·1656	44·8750*
S14	—	—	12·1145	14·9638	18·1718	44·8916*
S15	—	—	12·1145	14·9638	18·1718	44·8916*
S16	—	—	12·1167	14·9667	18·1750	44·9000*
S17	—	—	12·1187	14·9694	18·1781	44·9083*
S18	—	—	12·1208	14·9722	18·1812	44·9166*
S19	—	—	12·1229	14·9750	18·1843	44·9250*
S20	4·0416	8·0833	12·1250	14·9777	18·1875	44·9333
S21	4·0423	8·0847	12·1270	14·9805	18·1906	44·9416
S22	4·0430	8·0861	12·1291	14·9833	18·1937	44·9500
S23	4·0437	8·0875	12·1312	14·9861	18·1968	44·9583

SR = Series resonance ***HC25 only**

The above list includes crystals for the folowing equipment R0 to R7 and S8 to S23 for following Belcom FS1007, FDK TM56, Multi 11 Quartz 16 and Multi 7, Icom IC2F, 21, 22A and 215. Trio Kenwood 2200, 7200, Uniden 2030 and Yaesu FT2FB, FT2 auto, FT224, FT223 and FT202.

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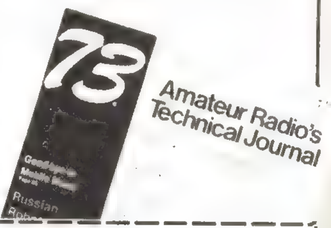

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basic values are in steps of 10, 12, 15, 18, 22, 27, 33, 39, 47, 56, 68, 82 and their decades. The E24 series has an extra set of a further 12 values included (11, 13, 16, 20, 24, 30, 36, 43, 51, 62, 75 and 91).

Rather than sit down with a calculator and work out the values required, a TRS-80 microcomputer was set the task of doing the donkey work by calculating the parallel values, knowing the single resistor value required. The program used, including comments is listed at the end of this article. If you have another machine the Basic dialect used is reasonably easily translated to an alternative.

An example of the program output is given – if you want, the PRINT instructions can be changed to LPRINT for hard copy. The program will give all resistor combinations in the E24 series which meet the % tolerance requirements you have entered. You may well find other uses for the program not connected with attenuators.

For those who don't have such a machine, the values required for pi-network attenuators in commonly required steps are given in the table, both for 50 & 75 ohm input and output impedances. 1% metal oxide resistors should be used for best accuracy, with the single resistor given consisting of two parallelled resistors with the values shown.

This attenuator is intended for general use and uses the values of 1, 2, 4, 8, 16, 16 & 32dB with each value on a pushbutton switch which can be selected or bypassed at will. With this combination of steps any value between 1 and 79dB can be selected, although even with the careful design and screens between all switches, the unit loses accuracy above about 60 – 70dB due to leakage. A suitable pcb design is given for the attenuator, using the ALPS SUE range of pcb mounting switches. The parts including the case, are readily available.

Construction

The construction of the attenuator is very simple (refer to *Figures 2 & 3*). Solder the resistors into place keeping the leads as short as possible, then mount the switches directly on the pcb, after fixing into the retaining bracket. Suitable screens are supplied with the kit, or they can be fabricated from tinplate, 6 are required, size 17 x 50mm, and mounted using pcb connection pins in the holes provided. The whole unit is held against the front panel of the case with ½in spacers and 6BA screws, with the panel drilled to suit the switch (15mm centres).

Input and output sockets are required, and 50 or 75 ohm BNC sockets are advised, with connections to the pcb made by short lengths of coaxial cable of the correct impedance, earthed at both ends. In the prototype illustrated, the sockets were on the back panel. The case shown is relatively expensive, but matched the author's other test equipment – a cheaper version can be used if preferred.

Amateur bands

If you have trouble on the amateur 7MHz band at night, or on the shortwave bands from strong broadcast stations, try this attenuator unit – you will be surprised how stations you couldn't previously hear are perfect copy with a few dB's in the antenna lead. **DON'T transmit** into the unit though. Note that in a few cases, only a single resistor is wanted where the value required is part of the E24 series. 68/240 = 68 ohms in parallel with 240 ohms etc. The single resistor value above each pair is the theoretical value required, and is obtained with the parallel combination shown below it.

PARTS LIST

Set of resistors as required for impedance chosen 7 way SUE switch assembly, push to make, push to break types.

4 0.1" connection pins.
Case
Case
6BA screws
2x 0.5" spacers.
2x 50 or 75 ohm BNC panel mounting sockets.
6 tinplate screens 17 x 50mm
Short lengths of coaxial cable.

A PCB for this project is available from Edwardschild Limited, 453a Becontree Ave, Dagenham, Essex RM8 3UL at £1.30 each.

TABLE OF RESISTOR VALUES FOR ATTENUATOR

	50 ohm		75 ohm	
dB	R1	R2	R1	R2
1	5.7 11/12	870 910/20k	8.5 10/56	1k3 1k3
2	11.6 12/360	436 510/3k	17.4 18/510	653 5k1/750
4	24 24	213 220/6k8	36 36	320 470/1k
8	52.9 62/360	116 120/3k9	79.2 82/2k4	174 180/5k1
16	154 240/430	69 82/430	231 240/6k2	103.5 120/750
32	1k 1k	53 68/240	1k5 1k5	79.5 82/2k7

```
100 'PARALLEL RESISTOR VALUE CALCULATION
110 'FOR TRS – 80 MODEL 1 LEVEL 2
120 'PROGRAM REQUIRES 1.9K OF MEMORY WITH REM STATEMENTS
130 'COPYRIGHT R & EW 1982
140 CLS:PRINT@460,"PARALLEL RESISTOR VALUE CALCULATIONS
150 FOR X%=1 TO 2000: NEXT
160 CLS:DIM R(121):M=1
170 X$="££,£££,£££":Y$="££,£££,£££.££"
180 'READ VALUES OF DECADES AND MULTIPLY
190 FOR Y%=0 TO 96 STEP 24:FOR X%=1 TO 24:READ R(X%+Y%):
R(X%+Y%)=R(X%+Y%)*M:NEXT X%:RESTORE:M=M*10:NEXT Y%: R(121)=1000000
200 'SET PERCENTAGE TOLERANCE FOR ACCEPTANCE
210 INPUT"ENTER % TOLERANCE ALLOWED FOR ANSWERS";L
220 IF L=O OR L>20 PRINT"OUT OF LIMITS":GOTO 210
230 'INPUT AND SET LIMITS AT +/- L
240 C%=1:INPUT "ENTER RESISTOR VALUE REQUIRED IN OHMS";Y
250 IF Y<5.24 OR Y>500000 PRINT"VALUE OUT OF PROGRAM RANGE":GOTO 240
255 Y1=Y*(1+L/100):Y2=Y*(1-L/100)
260 'STORE RECIPROCAL OF FIRST VALUE
270 FOR A%=1 TO 121:T!=1/R(A%):C%=C%+1:IFC%=122 THEN 350
280 'CHECK IF DECADE TOO LOW
290 P=1/(T!+1/R(121)):IF P < Y2 THEN 350
300 FOR B%=C% TO 121:P=1/(T!+1/R(B%))
310 'CHECK IF DECADE TOO HIGH
320 IF P>Y1 THEN B%=121:GOTO 340
330 IF P>Y2 AND P<Y1 THEN PRINT USING X$;R(A%);:
PRINT" IN PARALLEL WITH" USING X$;R(B%);:
PRINT" GIVES" USING Y$;P
340 NEXT B%
350 NEXT A%:PRINT:GOTO 200
360 DATA 10, 11, 12, 13, 15, 16, 18, 20, 22, 24, 27, 30, 33, 36, 39, 43, 47, 51, 56, 62, 68, 75, 82, 91
370 END
```

```
ENTER % TOLERANCE ALLOWED FOR ANSWERS? .5
ENTER RESISTOR VALUE REQUIRED IN OHMS? 34
  36 IN PARALLEL WITH     620 GIVES      34.02
  39 IN PARALLEL WITH     270 GIVES      34.08
  43 IN PARALLEL WITH     160 GIVES      33.89
  62 IN PARALLEL WITH      75 GIVES      33.94

ENTER % TOLERANCE ALLOWED FOR ANSWERS? .2
ENTER RESISTOR VALUE REQUIRED IN OHMS? 1208
  1,500 IN PARALLEL WITH     6,200 GIVES      1,207.79

ENTER % TOLERANCE ALLOWED FOR ANSWERS? _
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0080	XF8 9KA	6kHz AM filter	17.25
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0720	FWB2	Spare Ni-cad battery pack	19.95
0740	FBA3	Charging sleeve	5.35
0760	NC7C	Base master charger	30.65
0770	NC8C	Base master quick charger	50.60
0780	PA3	Charger 12v DC	14.20
0800	MMB10	Mobile mounting bracket	6.90
1000	FT230R	2m 25W FM mob t'ceiver	255.00
1010	FT730R	70cms 10W FM mob t'ceiver	PHONE
1020	FT726R	3 band all mode base station	PHONE
1030	430T726	70cms module	230.00
1050	50T726	6 metre module	170.00
1051	HFT726R	HF module	180.00
1060	SAT726	Full duplex x/band unit	90 00
1090	FRG7700	0.2-30mHz gen cov rec	PHONE
1100	FRG7700M	7700 with memory unit	PHONE
1110	MEMGR7700	Memory module	98.90
1120	DCRG7700	DC modification kit	2.95
1130	FRT7700	Antenna tuner unit	42.55
1201	FRA7700	Active Antenna	38.70
1140	FF5	Low pass filter	9.95
1150	FRV7700A	118-130, 130-140, 140-150mHz	78.95
1160	FRV7700B	118-130, 140-150, 50-59mHz	84 70
1170	FRV7700C	140-150, 150-160, 160-170mHz	74.75
1180	FRV7700D	118-130, 140-150, 70-80mHz	80.90
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ICOM

2005	IC751	*NEW * 100W H F.	969.00
2008	IC745	*NEW * 100W H.F	769.00
2010	IC740	100w HF trans 12v DC	PHONE
2020	PSU(Int)	230v AC power supply	134.00
2030	FM(EX242)	FM module for above	26.00
2040	KEYER(EX243)	Keyer module for above	36.00
2100	IC730	100w HF trans 12v DC	695.00
2120	FL30	SSB pass band filter	29.00
2190	IC720A	100w HF trans plus gen. cov	PHONE
2200	PS15	230v p.s.u. for HF t'ceivers	119.00
2210	PS20	230v chopper type unit	155.00
2150	FL45	500Hz filter for 740/730	39.00
2050	FL44	2.4kHz SSB filter	65.00
2220	FL32	CW narrow filter for 720	34.00
2230	FL34	AM filter for 720	29.00
2150	EX202	LDA unit for 730	13.50
2160	EX203	CW audio filter for 730	14.00
2170	EX205	TRV unit for 730	11.50
2240	B10	Memory back up for 720	5.75
2290	IC2KL	500W solid state linear	915.00
2300	IC2KL PSU	Matching 230v AC PSU	256.00
2310	AT100	100 watt HF Auto ATU	249.00
2320	AT500	500 watt HF Auto ATU	349.00
2340	CF1	Cooling fan	20.50
2350	SP3	Matching ext speaker	39.00
2360	HP1	Communication phones	25.00
2370	SM5	Base microphone	29.00
2250	IC-R70	Comms rec 230v AC	PHONE
2260	FM unit	Plug in module	30.00
2270	FL63	CW narrow filter	32.50
2050	FL44	Xtal filter	65.00
2410	IC290H	Multimode 2m 12v DC	433.00
2430	BU1	Back up supply	20.00
2440	IC471	Multimode 70cm	689.00

ICOM CONT

2450	IC490	Multimode 70cm 12v DC	459.00
2480	IC2E	2m synth h'held 1.5w	159.00
2490	IC4E	70cm synth h'held 1.5w	189.00
2760	MMB2	Mobile mounting bracket	t.b.a.
2770	MMB5	Mobile mounting bracket	12.50
2810	MMB9	Mobile mounting bracket	12.50
2840	MMB12	Mobile mounting bracket	11.50
2850	HM3	4 pin hand mic.	12.50
2870	HM7	8 pin hand mic.	12.50
2890	HM9	L/S mic for IC2E/4E	15.00
2900	HM10	Up/down scan mic.	20.00
2950	SM2	4 pin desk mic.	29.00
2960	SM5	8 pin desk mic.	29.00
2970	SP3	External loudspeaker	39.00
2520	LCX3	Cases for IC2E/4E	4.25
2570	BC25	Standard mains charger	5.75
2590	BC30	Base hod type charger	49.00
2610	BP2	Low voltage pack	30.00
2620	BP3	Standard pack	23.00
2630	BP4	Empty battery box (AA cells)	6.95
2640	BP5	High power battery pack	44.00
2650	CP1	Charger lead for 12V supply	4.49
2660	DC1	12v Regulator pack	[illegible]

TRIO/KENWOOD

1450	TS930S	160-10m t'ceiver with gen cov	1095.00
1460	AT930	Automatic ATU 80-10m	141.75
1470	SP930	External speaker unit	99.00
1490	YK88A-1	6kHz AM filter	33.25
1500	YK88C-1	500Hz CW filter	33.25
1510	YG455C-1	500Hz CW filter	77.50
1520	YG455CN-1	270Hz CW filter	91 75
1530	TS430S	160-10m with gen cov rec	736.00
1540	PS430	Mains PSU for TS430S	112.75
1550	SP430	Speaker for TS430S	29.50
1570	FM430	FM option unit TS430S	34.50
1580	YK88C	500Hz CW filter	31.75
1590	YK88CN	270Hz CW filter	37.25
1600	YK88SN	1.8kHz SSB filter	32.50
1850	TL922	160-10m 2kw linear	724.50
1870	MC60 N4	Desk microphone	51.50
1880	MC60 S6	Desk mic with up/down	53.50
1890	MC60A	Desk mic with pre-amp	55.25
1900	MC35S	Fist mic 50K imp	14.75
1910	MC30S	Fist microphone 500ohm imp	14.75
1920	MC40S	Up/down mic for TR9000/7800	14.75
1930	MC42S	Up/down mic (TS930S)	15.25
1940	LF30A	LF low pass filter	21.25
1950	TS780	2m/70cm all mode t'ceiver	785.00
1980	TR9130	2m multi mode mobile	433.50
1934	TW4000	FM transceiver 2m/70cm	425.00
1680	TR2500	2m FM synth handheld .	219.00
1700	ST2	Base stand and charger	51.75
1710	SC4	Soft case and belt hook	13.75
1720	MS1	Mob stand and power unit	31.75
1730	SMC25	Speaker/microphone	16.00
1750	LH2	Deluxe leather case	24.00
1770	DC25	Power supply from 12V	16.00
1780	TR3500	70cm handheld trans.	225.00
1790	TR9500	70cm multimode mob	395.00
1800	R600	Gen cov rec 150kHz-30MHz	239.00
1820	R2000	Gen cov rec	389.00
1821	HC10	World time clock	62.00

DATONG

3880	PC1	Gen cov convertor	137.40
3870	VLF	Very low frequency convertor	29.90
3670	ANF	Freq agile audio filter	67.85
3660	FL2	Multi-mode audio filter	89.70
3650	FL3	Auto filter for receivers	129.00
3700	ASP/B	r.f. speech clipper for Trio	82.80
3700	ASP/A	r.f. speech clipper for Yaesu	82.80
3710	D75	Manual RF speech clipper	56.35
3740	D70	Morse Tutor	56.35
3750	MK	Keyboard morse sender	137.40
3910	RFA	RF switched pre-amp	33.90
3800	AD270	Active dipole indoor	47.15
3820	AD370	Active dipole outdoor	64.40
3810	AD270-MPU	As above with mains p.s.u.	51 75
3830	AD370-MPU	As above with mains p.s.u.	69.00
3980	MPU	Mains power unit	6.90
3730	RFC/M	RF speech clipper module	29.90
3920	PTS1	Tone squelch unit	46.00
3640	SRB2	Auto Woodpecker blanker	86.25

MICROWAVE MODULES RANGE

3130	MML28/100-S	10m 100W lin/preamp	129.95
3140	MML70/50	4m 50 watt lin/preamp	85.00
3150	MML70/100-S	4m 100W lin/preamp	139.95
3160	MML144/30LS	2m 30W linear amp	69.95
3170	MML144/50S	2m 50W lin/preamp	85.00
3180	MML144/100-S	2m 100W lin/preamp	139.95
3190	MML144/100LS	2m 100W (1 or 3W i/p)	159.95
3200	MML432/30L	70cm 30W lin/preamp	99.00
3210	MML432/50	70cm 50W lin/preamp	109.95
3220	MML432/100	70cm 100 watt linear	228.65
3250	MMC435/51	70cm ATV con, VHF out	37.90
3260	MMC435/600	70cm ATV con, UHF out	27.90
3270	MTV435	70cm ATV 20W t'mitter	149.00
3290	MM1000KB	Converter with keyboard	99.95
3300	MM2001	RTTY to TV converter	189.00
3320	MM4001KB	RTTY term with keyboard	299.00
3330	MMS1	The MORSETALKER	115.00
3340	MMS2	Advanced morse trainer	169.00
3350	MMT28/144	10m linear transverter	109.95
3360	MMT70/28	4m linear transverter	119.95
3370	MMT70/144	4m linear transverter	119.95
3380	MMT144/28	2m linear transverter	109.95
3390	MMT432/28-S	70cm linear transverter	159.95
3400	MMT432/144-R	70 cm linear transverter	184.00
3410	MMT1296/144	23cm linear transverter	184.00
3425	MMC27/MW	27MHz to med wave conv	19.95
3430	MMC28/144	10m to 2m up conv	29.90
3440	MMC50/28	6m to 10m down conv	29.90
3450	MMC70/28	4m to 10m down conv	29.90
3460	MMC70/28LO	4m to 10m down conv	32.90
3470	MMC144/28	2m to 10m down conv	29.90
3480	MMC144/28LO	2m to 10m down conv	32.90
3490	MMC432/28-S	70cm to 10m down conv	37.90
3500	MMC432/144-S	70cm to 2m down conv	37.90
3510	MMC1296/28	23cm to 10m down conv	34.90
3520	MMK1296/144	23cm to 2m down conv	69.95
3530	MMK1691/137.5	1691mHz Meteosat conv	129.95
3540	MMA28	10m low noise preamp	16.95
3550	MMA144V	2m RF switched preamp	34.90
3560	MMA1296	23cm low noise preamp	34.90
3570	MMd050/500	500MHz digital freq meter	75.00
3580	MMd600P	600mHz-10 prescaler	29.90
3590	MMDP1	Freq counter amp/probe	14.90
3620	MMS384	384mHz freq source	29.90
3630	MMR15/10	15dB, 10W attenuator	11.90

AZDEN

4060	PCS4000	2mFM transceiver 25W	229.00
4130	MEX55	Mobile boom safety mic	28.50

FDK

5779	M.750XX	2m FM/SSB/CW 10W t'ceiver	315.00
5782	EXP.430	M.750 70cm transverter	249.00
5772	KP100	AC/DC Electronic Keyer	69.00
5780	ATC720	Synth air monitor 110-138MHz	159.00
5781	RX40	Synth FM mon 140-180MHz	149.00

MUTEK LTD

5850	SLNA 50s	50MHz low noise switched preamplifier using BF981	37.10
[illegible]	SLNA 70s	70MHz low noise switched preamplifier using BF981	37.10
5870	SLNA 70u	70MHz low noise unswitched preamplifier using BF981	[illegible]
5880	SLNA 70ub	Unboxed version of SLNA 70u	13.70
5890	SLNA 144s	144MHz low noise switched preamplifier using BF981 (0.9dB noise figure)	37.10
5900	SLNA 144u	144MHz low noise unswitched preamplifier using BF981	22.40
5910	SLNA 144ub	Unboxed version of SLNA 144u	13.70
5920	SLNA 145sb	Transceiver optimised preamplifier with antenna c/o switching using BF981. Intended for the FT290R, but has many other applications!	27.40
5930	GFBA 144e	Ultra-high performance environmentally housed switched gasfet preamplifier using advanced negative feedback circuitry for superb dynamic performance. Supplied with ATCS 144s controller	129.90
5940	TLNA 432s	Very high performance bipolar transistor switched preamplifier for 430-440MHz using BFQ69 for 1.4dBnf and 0dBm input intercept performance	74.90
5950	TLNA 432u	Unswitched boxed variant of TLNA 432s	29.00
5960	TLNA 432ub	Unboxed TLNA 432u	20.40
5970	GLNA 432u	Series 432 MHz gasfet unswitched preamplifiers	PHONE
5980	BLNA 432ub	Sub-miniature 1.3dBnf BFQ69 preamplifier	13.70

MUTEK LTD

5990	BLNA 1296ub	Noise lna
6000	RPCB 144ub	Comp for th
6010	RPCB 251ub	Comp for th
6020	HDRA 95u-1	1.5dB range
6030	HDRA 95u-2	11 5d
6040	BBBA 500u	20-50 dynar
6050	BBBA 860u	250-8 ampli
6060	XBPF 700ub	Micro
6070	PPSU 012	12V (r HDRA
6080	CISA 001	'UHF'(
6090	ATCS 144s	Transr seque

WRAASE ELECT

SLOW SCAN EQUIPME

4720	SC140	SST
4730	SC160	SST
4740	SC442A	SST
4775	SC-1	SST
4750	FG422A	Ligh
4760	KB422A	Key
4780	Prince	12"

SCANNING REC

5573	Sony ICF7600D Digi
5574	Power supply mains,
5580	Bearcat BC100 synth
5610	Bearcat BC2020FB A
5650	Jil SX200N AM/FM
5651	Jil SX400 26-510MHz
5659	Gemscan Synthesise
5641	AOR2001 Synth. 26-5
5770	Fairmate AS32320 A airband
5760	Corona CD6000 AM
5781	FDK RX40 pocket syn 180MHz
5780	FDK ATC720 pocket s receiver

VHF/UHF AMPL

TONO PRODUCTS

5340	2M-50W	40W
5350	2M-100W	90W
5360	MR-150W	140W
5370	MR-250W	210W
5380	MR28	100W
5390	4M60	50W

TOKYO HY-POWER LABS

5670	HC-150	3.5MH
5680	HC2000	1.8MH
5690	HL-82V	2M lin includ
5700	HL-160V	2M lin includ I/P
5709	HL-45U	70cm 50W C
5711	HL90U	70cm l O/P *N

ALINCO ELECTRONICS

5720	ELH230E	2M lin P smal
5730	ELH710	70cm l 3W I/P
5740	ELH730	As abo
5741	ELH230D	As ELH (switch
5742	ELH250D	2M line pre-am

See full range of BNOS and

DAVETREND LTD

4670	VHF/W	Wavem
4680	4APSU	4 amp
4690	6APSU	6 amp
4700	12APSU	12 amp
4710	24APSU	24 amp
4711	MT1	Morse t

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psu 49.00

MORSE KEYS

HI-MOUND KEYS

5430	HK702	Up/down on marble	26.94
5440	HK704	Up/down super deluxe	17.65
5450	HK705	Up/down deluxe	13.80
5460	HK706	Up/down economy	14.60
5461	HK707	Up/down popular	13.75
5470	HK708	Basic unit up/down	13.26
5480	MK704	Squeeze keyer manipulator	12.65
5490	MK705	As 0548 with metal base	21.28
5501		Ex-ministry No 8 key, original packing	4.95

Bencher Products

5220	BY1	Keyer paddle (black base)	37.95
5230	BY2	Keyer paddle (chome base)	48.30
5240	BY3	Keyer paddle (gold plated)	92.00
5250	ZA1A	Balun 3.5-30MHz for dipoles	15.00
5260	ZA2A	Balun 14-30MHz for beam antennas	17.25

RTTY/CW READERS

Tasco Products

5400	CWR685E	Tele reader – RTTY/CW/ASCII	769.00
5410	CWR670	Tele reader – as above, RX only	349.00
5420	CWR610E	Tele reader – as above, basic unit	159.00

Tono Products

5270	9000E	CW/RTTY/ASCII/Editor/lite pen, term L	869.00
5280	550E	CW/RTTY/ASCII/Terminal RX	299.00
5290	350	CW/RTTY/ASCII/Terminal RX only	259.00
5300	CRT120G	VDU 12 inch green screen – mains power	125.00
5310	CRT1200G	VDU 12 inch for 80 columns	136.00
5320	HC800	Line printer centronics	449.00
5330	SK7	Plug adaptors for printers	8.50

ICS Electronics

4900	AMT-1	Amtor RX/TX	275.00

BNOS ELECTRONICS

5800	12/6A	Power supply 13.8V 6 amp, fully protected	48.30
5810	12/12A	Power supply 13.8V 12 amp, fully protected	86.40
5820	12/24A	Power supply 13.8V 25 amp, fully protected	125.45
5830	12/40A	Power supply 13.8V 40 amp, fully protected	225.40
5831	L144/1/100	1 watt input linear	138.00
5832	L144/3/100	3 watt input linear	138.00
5833	L144/10/100	10 watt input linear	115.00
5834	LPM144/1/100	1 watt input linear/preamp	172.50
5835	LPM144/3/100	3 watt input linear/preamp	172.50
5836	LPM144/10/100	10 watt input linear/preamp	149.50
5837	L144/25/160	25 watt input linear	155.00
5838	LPM144/25/160	25 watt input linear/preamp	189.50
5839	L144/10/180	10 watt input linear	178.00
5840	LPM144/10/180	10 watt input linear/preamp	212.50

TONNA ANTENNAS F9FT

50MHz		L(M)	W(kg)	
6100	5 element	3.5	3.2	34.30
144MHz				
6103	4 element	0.87	0.5	14.95
6110	9 ele fixed	3.3	1.9	17.71
6120	9 ele portable	3.3	1.7	20.00
6130	9 ele crossed	3.5	2.0	32.43
6140	13 ele portable	4.5	2.5	31.05
6150	17 ele fixed	6.60	4.5	37.66
435MHz				
6190	19 element	3.2	1.1	20.70
6189	19 ele crossed	3.3	1.8	34.27
6200	21 element	4.6	2.6	29.62
6210	21 element ATV	4 6	2 6	29.67
144/435HMz				
Oscar Special				
6160	9 & 19 element	3.3	2.0	4.27
1,250MHz or 1,296MHz				
6213	23 element	1.8	0.9	25.90
6214	4 × 23 ele antennas – power splitter – stacking frame			140.00

Full range of J Beam, T.E.T. and Yaesu antennas available!

WELZ

4980	SP200	1 8-160MHz PWR/SWR	69.95
4990	SP300	1.8-500MHz PWR/SWR	97.00
5000	SP400	130-500MHz PWR/SWR	69.95
5010	SP600	1 8-500MHz PWR/SWR	97.00
5040	SP10X	1.8-150MHz PWR/SWR	24.45
5020	SP15M	1.8-160MHz PWR/SWR	35.00
5030	SP45M	130-470MHz PWR/SWR	51.00
5050	SP250	1.8-60MHz PWR/SWR	49.50
5060	SP350	1.8-500MHz PWR/SWR	59.95
5080	AC38	3.5-30MHz ATU 400w PEP	65.00
5160	TP05X	50-500MHz 0-5W meter	13.95
5131	CA35A	Static protector	10.75
5132	CA23N	Static protector	12.60
5090	CT15A	15/50W dummy load PL259	7.95
5100	CT15N	15/20W dummy load N plug	13.95
5110	CT150	150/400W dummy load	35.50
5120	CT300	300/1kW dummy load	49.50
5130	CT03N	3W dummy load 1.3gHz	30.00
5140	CH20A	2 way coax switch SO239	17.95
5150	CH20N	2 way coax switch N socket	31.95
5133	DF72C	144/430MHz duplexer	18.95

WELZ DIAMOND AERIALS

7800	RH2B	2m ¼ wave whip BNC	8.95
7810	RG200B	2m half wave whip BNC	18.95
7820	RH702B	70cm 2 × 5/8 whip BNC	16.00
7830	M285	2m 5/8th mobile PL259	8.50
7840	M287	2m 7/8th mobile	14.95
7850	EL770E	Dual band 2m/70cm mobile	18.95
7860	B285	2m 5/8th base with radials	14.95
7870	GH22	2m 2 × 5/8th base	27.95
7880	GH72	70cm 2 × 5/8th base	27.50
7890	DP100S	80-10m mobile system 100w	79.95
7960	GLS	Gutter mount with 4m cable	8.95
7970	GLP	SO239 vehicle mount	2.75
7980	SPM	Heavy duty magnetic base	12.95
7990	TRB	Heavy duty trunk lip mount	11.50
8000	LOR	14" elevated ground plane	18.50
8010	LBR	Heavy duty base spring	10.50
8020	BDS	Bumper mounting strap	9.50
8030	BSB	As LBR with ball adjustment	8.50
8040	EL80	Base loaded whip 3.5MHz	37.00
8050	EL40	Base loaded whip 7MHz	32.50
8060	CP3	6-10-15 vertical with G.P.	69.00
8070	CP4	10-40m vertical with G.P.	89.00
8080	CP5	10-80m vertical with G.P.	115.00
8090	KB101	10-40m 1kw vertical	55.00
8100	KB105	10-80m 1kw vertical	79.50

SUN ANTENNAS

9900	KG209SE2	7/8 + cap hat 2M	13.95
9910	KG309SE2	5/8 + cap hat 2M	9.95
9915	KG366	5/8 standard 2M	7.95
9920	KG144GP	3 × 5/8 base colin 2M	26.95
9925	KG110G	Gutter mount	2.95

NEW RANGE – OSKER BLOCK

9950	SWR300	VSWR + power meter 3.5-30MHz 2KW	59.95
9955	SWRWV3	Economy version of SWR300, add required inserts	29.95
9960	SWR145	VSWR + power meter 144-155MHz 250W	27.95
9965	SPC6A	Insert for 300/WV3 0-2W/0-20W 50MHz	15.95
9970	SPC6B	Insert for 300/WV3 0-20W/0-200W 50MHz	15.95
9975	SPC2A	Insert for 300/WV3 0-2W/0-200W 144MHz	15.95
9980	SPC2B	Insert for 300/WV3 0-20W/0-200W 144MHz	15.95
9985	SPC07A	Insert for 300/WV3 0-2W/0-20W 432MHz	15.95
9990	**SWR300** + choice of 3 inserts	**Special price**	84.95
9995	**SWRWV3** + choice of 3 inserts	**Special price**	59.95

THIS MONTH'S SPECIALS

- *9680* Confidential Frequency list. Latest edition 10.95
- *10100* Noda Tushin 427H RMS/PEP 1 8-150MHz power meter 74.95
- Full range of WPO communication kits in stock PHONE
- Many second hand items refurbished by us are now available Typical examples:

FRG 7700	from	£239.00
FT290R	from	£185.00
2M amplifiers	from	£29.00

Just write, or pick up the phone, quote the Stock Number, together, with your Access or Barclaycard and the goods are despatched within 24 hours!

If the particular item you require is not listed, dial 01-992 5767 or 092 52 29881 — Brenda and Bernie pride themselves in supplying anything in Amateur Radio!

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BARCLAYCARD
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DESIGNER'S UPDATE

This month, a look at helical filters – in particular those produced by TOKO

Since TOKO discovered a virtuall untapped market a couple of years bac with their 'stock' series of helical filter for UHF, the interest and demand tha these engendered has caused the serie to blossom into a complete rang covering from 130MHz to 1GHz – wit only a couple of gaps.

The availability of preset selectivit over this range of frequencies has bot spawned a number of more adventurou designs in amateur communication equipment, and taken some of the strai off designers of pagers and othe professional miniature communication equipment where predictable an repeatable selectivity at VHF and UHF i generally about half the design battle.

When selecting a helical filter fo signal path applications, the prim concern will be attenuation at the imag frequency. This is twice the IF frequenc away from the desired signal – which

Examples

Item / Type		7 H W	7 H T	H R W
Center frequency		435MHz	855MHz	435MHz
Band width (1dB)		15MHz	15MHz	11MHz
Attenuation	fo +30MHz	23dB	18dB	22dB
	fo +30MHz	25dB	22dB	27dB
Ripple		0.1dB	0 dB	0.3dB
Insertion loss		1.6dB	3 dB	0.3dB
Input-output impedance		50 Ω	50 Ω	50 Ω

Item / Type		H R Q	C B W	C B T
Center frequency		435MHz	145MHz	145MHz
Band width (1dB)		11MHz	3 MHz	3 MHz
Attenuation	fo +10MHz	28dB	20dB	28dB
	fo −10MHz	31dB	22dB	35dB
Ripple		0.7dB	0.3dB	0.5dB
Insertion loss		1.8dB	1.3dB	2 dB
Input-output impedance		50 Ω	50 Ω	50 Ω

Specifications

		Applicable frequency range	Band width	Input-output impedance
7 H W	Double-tuned type	230 ~ 1000MHz	over 6 MHz	50 Ω ~ 500 Ω
7 H T	Triple-tuned type	230 ~ 1000MHz	over 6 MHz	50 Ω ~ 500 Ω
H R W	Double-tuned type	350 ~ 520MHz	over 6 MHz	50 Ω
H R Q	Quadruple-tuned type	350 ~ 520MHz	over 6 MHz	50 Ω
C B W	Double-tuned type	130 ~ 220MHz	over 2 MHz	50 Ω ~ 500 Ω
C B T	Triple-tuned type	130 ~ 220MHz	over 2 MHz	50 Ω ~ 500 Ω

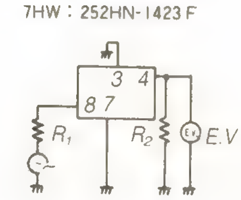


Fig 1 *Test circuit*

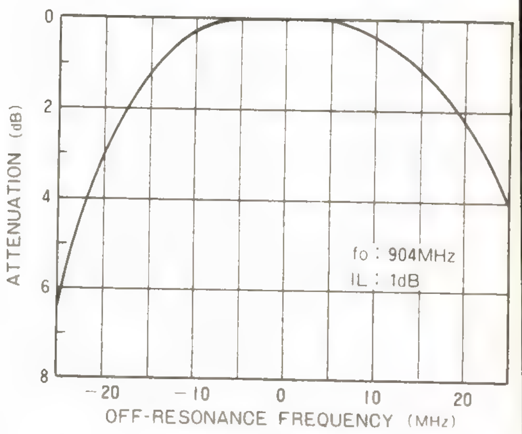


Fig 2 *Bandwidth characteristic*

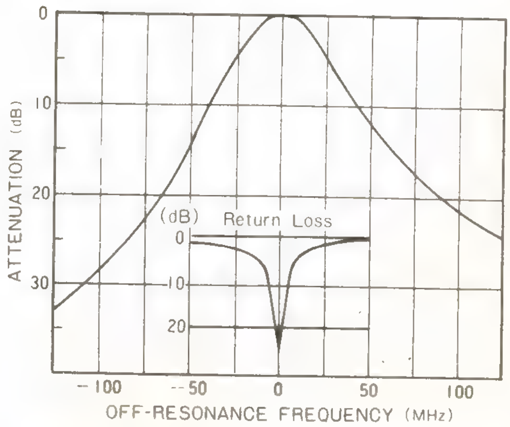


Fig 3 *Selectivity*

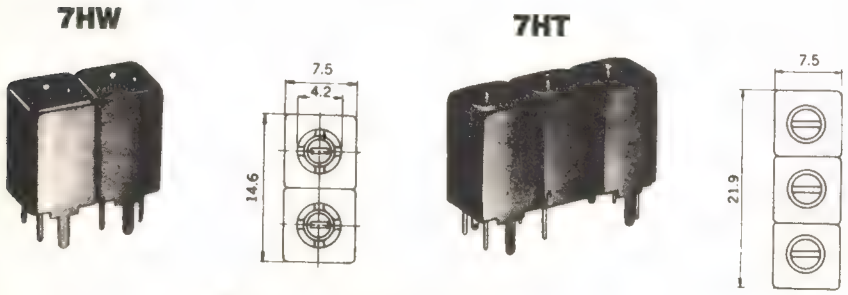


Fig 4 *Unit dimensions (mm)*

means 42.8MHz in most UHF applications where 21.4MHz is used (800–900MHz applications tend to use 45MHz) and 21.4MHz in VHF systems with an IF of 10.7MHz.

Helical filters right at the antenna socket will degrade the system noise figure by their insertion loss: so only use them without low noise pre-amplification where it is essential to do so. Used at the output of the RF stage, the insertion loss should not present any problems as the receiver noise figure will already have been determined.

Remember that helical filters tend to be nearly as good at the third harmonic of the fundamental as they are at the fundamental operating frequency. If this is likely to cause problems, then the filter should be used in conjunction with a simple low pass filter that will be effective at the third harmonic. A good example is the third harmonic of 160MHz. Quite a lot can be happening at 480MHz that you don't want cluttering up the input to your mixer.

UHF

The miniature UHF series (primarily for application in hand portables and pagers) comprises the 7HW and 7HT, which have two and three chambers respectively. The 7HW is for use both around the main amateur and commercial UHF frequencies from 410–470MHz, while the 7HT has been specifically prompted by the increasingly widely used 800MHz commercial band (primarily in the USA) and latterly by applications involving CB and cordless telephones which occur around 900MHz.

Miniature though these devices be, the 7HT is now also available in a slightly lower case size where the height above the PC board is limited to 12mm.

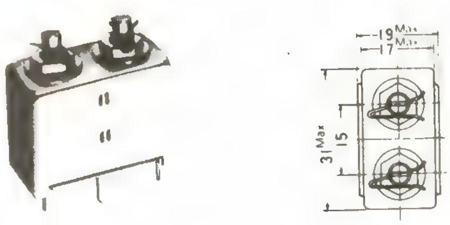
Where space is less of a problem, the HRW and HRQ may be used. These make up a 'full format' series that features lower insertion losses and a generally more stable all round environmental performance. The *Q* is naturally somewhat higher and, by very tight control of the manufacturing process and with exceptionally fine trimmer adjustments, the resulting bandpass characteristics are nearly 'textbook' representations of the genre.

VHF

The CBW and CBT series for VHF are to be found very widely both in amateur 2m transceivers and in marine radiotelephones at 160MHz. Both two and three chamber versions are available, although no miniature types are envisaged in view of the relatively longer wavelengths below 230MHz. (This frequency is in fact where the 7HW and 7HT series start.)

HRW type

Dimensions (Unit : mm)



HRQ type

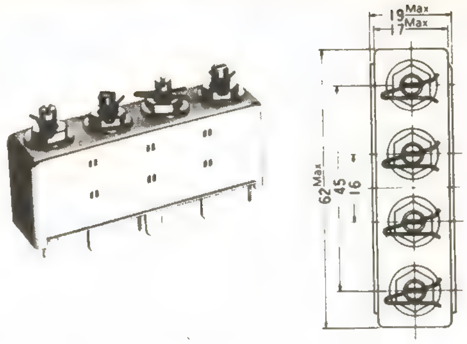


Fig 3

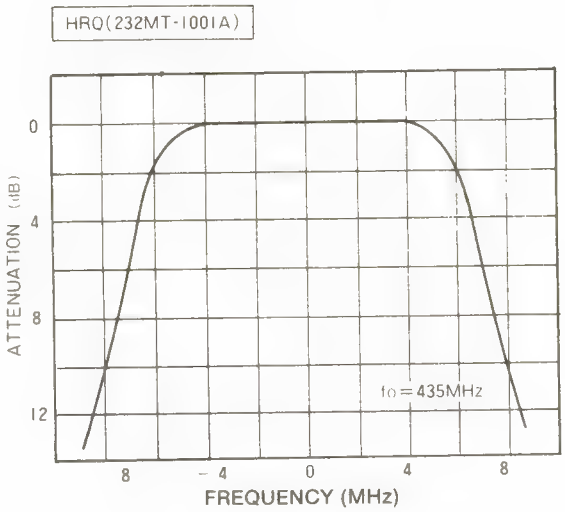
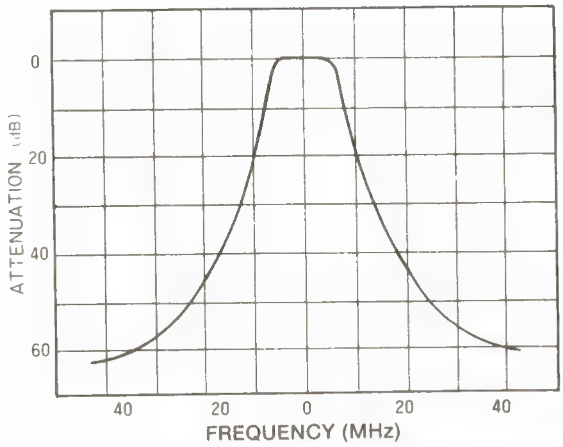
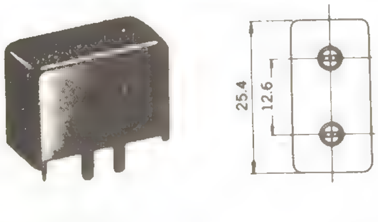


Fig 4

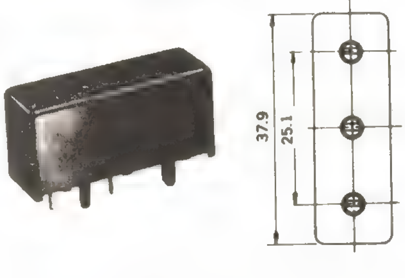


CBW type

Dimensions (Unit : mm)



CBT type



General comments

A filter is only as good as its terminations. Match the impedance stated on the data sheet and ensure that the ground (earth) has the lowest possible impedance. A double sided layout where the top is a ground plane is conventional at these frequencies.

The input and output must be well screened – although a controlled degree of 'feed-across' can produce some deep notches at the edges of the passband skirt (at the expense of ultimate stopband). The same principles are used to design the steep edges of ceramic and crystal filters – and it's worth bearing in mind that exactly the same mathematical principles apply to the design of UHF filters as do for LF: it's a matter of scale and practicality.

T.V. SOUND TUNER

SERIES II

BUILT AND TESTED

In the cut-throat world of consumer electronics, one of the questions designers apparently ponder over is "Will anyone notice if we save money by chopping this out?" In the domestic TV set, one of the first casualties seems to be the sound quality. Small speakers and no tone controls are common and all this is really quite sad, as the TV companies do their best to transmit the highest quality sound.

Given this background a compact and independent TV tuner that connects direct to your Hi-Fi is a must for quality reproduction. The unit is mains operated.

This TV SOUND TUNER offers full UHF coverage with 5 pre-selected tuning controls. It can also be used in conjunction with your video recorder. Dimensions: 10½"x 7½"x 2½".

£26·50 + £2.00 p&p.

E.T.I. kit version of above without chassis, case and hardware. **£16.20** plus £1.50 p&p.

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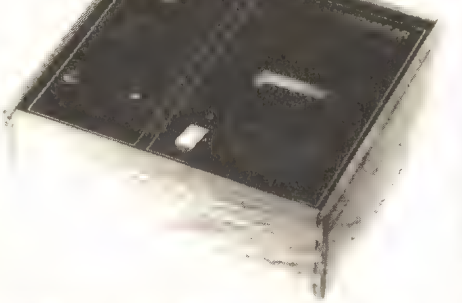

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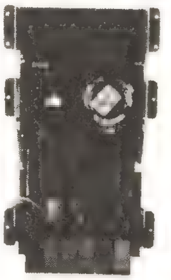

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Just requires mains transformer and input/output sockets and a volume control to complete. Supplied with full connection details.

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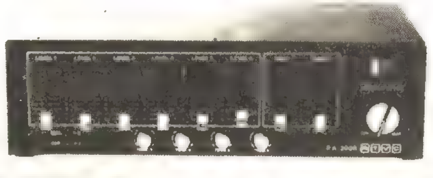
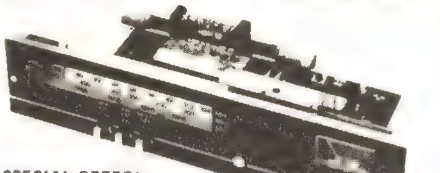


VHF STEREO TUNER KIT



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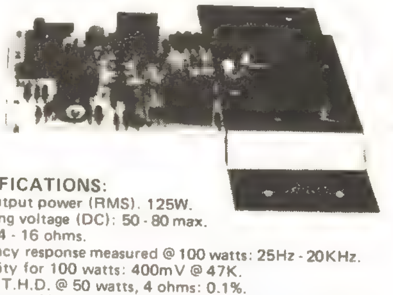
The power amp kit is a module for high power applications disco units, guitar amplifiers, public address systems and even high power domestic systems. The unit is protected against short circuiting of the load and is safe in an open circuit condition. A large safety margin exists by use of generously rated components, result, a high powered rugged unit. The PC board is back printed, etched and ready to drill for ease of construction and the aluminium chassis is preformed and ready to use.

Supplied with all parts, circuit diagrams and instructions.

ACCESSORY: Stereo/mono mains power supply kit with transformer. **£10.50 plus £2.00 p&p.**



SPECIFICATIONS:

Max. output power (RMS). 125W.

Operating voltage (DC): 50 - 80 max.

Loads: 4 - 16 ohms.

Frequency response measured @ 100 watts: 25Hz - 20KHz.

Sensitivity for 100 watts: 400mV @ 47K.

Typical T.H.D. @ 50 watts, 4 ohms: 0.1%.

Dimensions: 205 x 90 and 190 x 36 mm.

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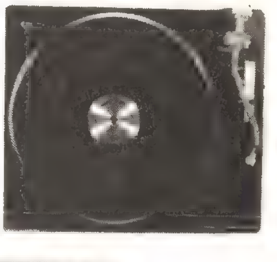

3 speed, auto, set-down; with auto return. Fitted with viscous damped cue, tubular aluminium counter-weighted arm, fitted with ceramic head. Ideally suited for home or disco use.

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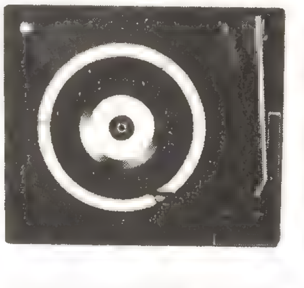

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R T V C

Moving Pictures From WAX – 'Phonovision'

Don McLean G6AWI reviews some Historical TV experiments

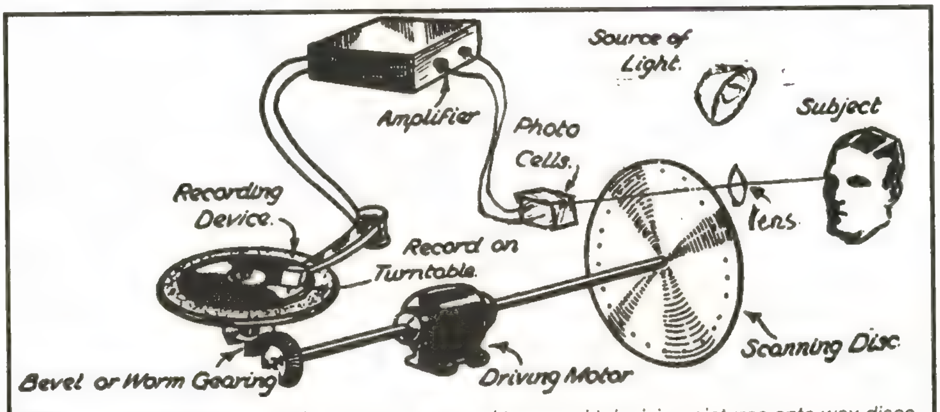


Fig 1 *A schematic lay-out of the apparatus used to record television pictures onto wax discs. Many different arrangements are possible. In the late twenties, photographs show the use of a worm gear and universal joints in the coupling between motor and turntable*

'Phonovision' – the first electrical TV recordings

The first television broadcasts in Britain began in the late 1920's when pictures were transmitted by the BBC using the Baird system. This television system was based on a mechanical approach to the problem of generating and displaying the picture. Each picture was built up from only 30 lines. It was crude even by the standards of the late 1930's when television as we know it first went on the air on a regular basis.

In the early days before 1930, the experimental work done by such pioneers as J L Baird served as a proving ground for the television that we have in our homes today. To Baird, though, must go the credit for the first electrical recordings of television signals and, in 1927, this invention (which he called 'Phonovision'), was announced. The signal from his camera was recorded directly onto wax discs during the process.

How could wax discs be used to record television pictures in the 1920's when today we have to use advanced techniques and equipment? The answer is that the Baird system was quite different to today's systems and only used 30 lines to make up each picture, whereas we now use 625 lines per picture. The 30 lines of Baird's system were only repeated 12½ times every second to give the illusion of movement but today the picture is shown 25 times every second. Consequently, the Baird TV signal contained much lower frequencies than today's television signal. This allowed the television signal to be transmitted in a voice channel on the medium waveband and also to be recorded onto wax discs.

Features of the recordings

The 'Phonovision' recordings had to be played at high speed (250 revolutions per minute) to give the Baird standard of 750 pictures every minute. We can say directly that there were three 30 line pictures recorded on each turn of the wax disc. It is quite from studying the video signal that the main scanning disc rotated once for each picture (at 750rpm). Hence for each revolution of the wax disc being recorded, the scanning disc made three revolutions.

The direct consequence of such a high speed is that the recordings were very short-lasting, on average, just under one minute at 250rpm.

It is clear that 'Phonovision' was not in itself practical and the general public would not have accepted 'vision-only' recordings that only lasted one minute.

Synchronisation – keeping the picture steady

Unlike the 30-line transmissions of the time, 'Phonovision' recordings were intended to overcome the problem of synchronising the camera in the studio with the home display. Synchronisation was and still is all important in television in order to keep the displayed picture correctly framed.

When the wax discs were recorded, the scanning mechanism indirectly rotated the recording turntable through a gearing arrangement. This meant that it was only necessary to have an identical linkage between the playback turntable and the display scanning disc when replaying a 'Phonovision' disc. Having an identical linkage would ensure that a perfectly stable picture would appear on the display.

This was fine in theory and the process was well publicised at the time but, in practice, all the 'Phonovision' discs suffered badly from serious picture distortion.

Recording speed variation

The earliest discs unfortunately suffer from fast fluctuation in the recording speed. This variation appears on the discs themselves and repeats every three pictures (one turn of the disc) randomly varying in size throughout the

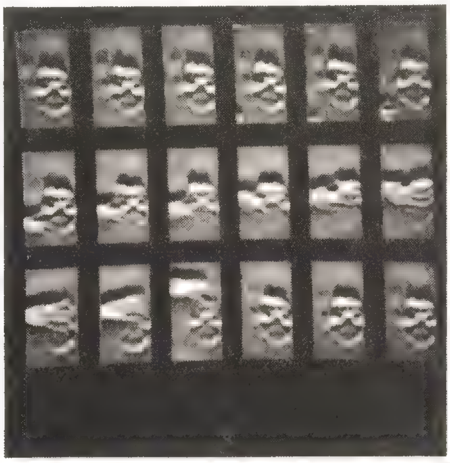


Fig 2 *18 frames from the September 1927 disc*

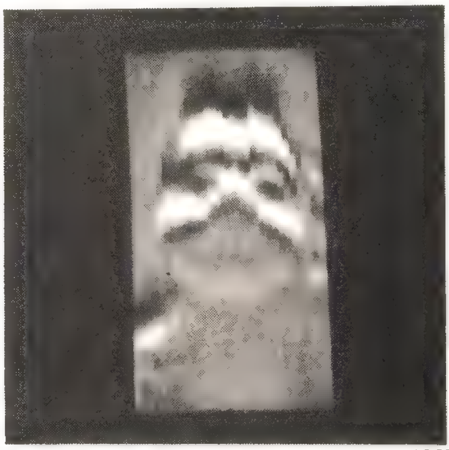


Fig 3 *A single frame from the September 1927 disc*

recording. The speed variation gets less towards the end of the recording, which is the innermost part of the disc.

An eye-witness remembers a 'Phonovision' recording session with the Columbia engineers discussing the disc being cut slipping on the smooth surface of the recording turntable. The very high recording speeds and the use of a heavy cutter arm on the disc increased the possibility of the disc slipping on the turntable and could have caused the speed variation.

Mechanical problems

If the effect of speed variation is removed, a surprising amount of information can be deduced from the picture shape. The misplaced lines of the picture that remain shifted throughout a recording were caused by poor workmanship in the construction of the disc that scanned the scene.

In the two earliest recordings, misplaced lines indicate that there was an error of about a half degree in positioning the 11th and subsequent holes around the circumference of the scanning disc. Each hole on the disc corresponds to a line in the picture. Because the same error appeared on two recordings which were dated four months apart, it is apparent that the same apparatus was used in both recordings.

Large displacement of the lines is evident in the latest of the 'Phonovision' recordings. This March 1928 recording shows great distortion and it is difficult to understand that it was due to poor construction of the scanning disc (particularly because earlier recordings show much less line shift). The shift may be due to vibration in the coupling shaft and bearings that link the scanning disc and the gearing arrangements.

The Major Radiovision disc – not 'Phonovision'

There has been some confusion about what constitutes 'Phonovision' as generated by Baird's late 1920's experiments. In 1935, a double-sided 30-line television disc was manufactured by the Major Radiovision Co.Ltd. and sold through the London store, Selfridges, for 7/6d. This has been claimed to be a 1928 'Phonovision' recording and is the easiest of all to buy, but for the serious collector it is important to establish the truth.

Table 1 summarises the main features of all the discs that have been studied from that period. The evidence shown here indicates that it is extremely unlikely that the Major Radiovision recording was made in 1928. It seems more likely that it was made during 1934-35 and may be as early as 1932. Another similar recording on a Major Radiovision disc has been associated with the 1934 period. The higher quality of these recordings excludes them from being copies of the earlier discs and the quality difference surely reflects the improvement in recording techniques and materials from 1927 to 1935. Despite the higher quality, the subject material of the later discs is of little interest today, showing as it does motionless cartoons of objects and people.

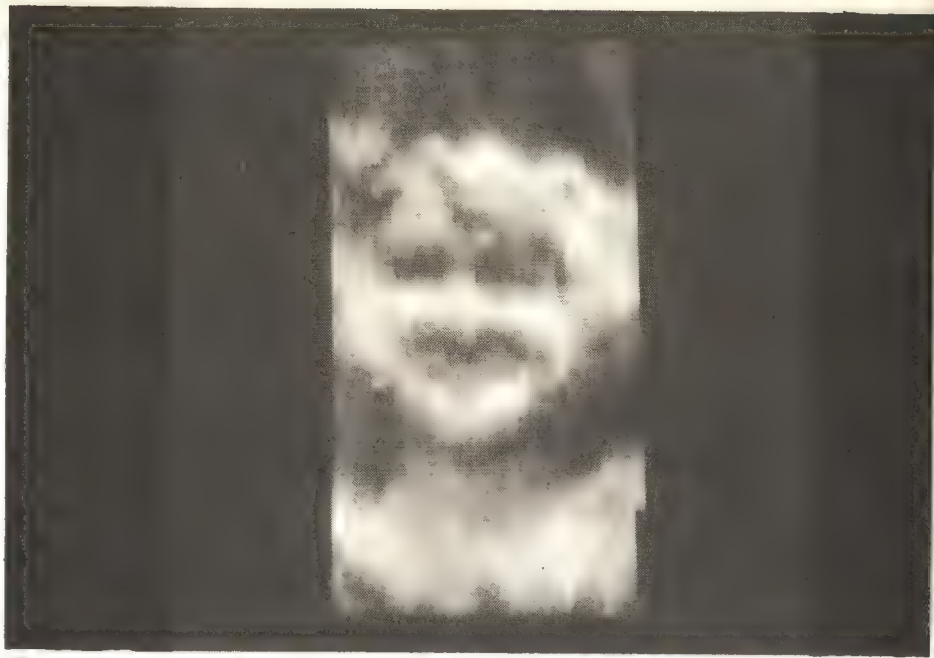


Fig 4 *'Miss Pounsford' from the March 1928 disc*

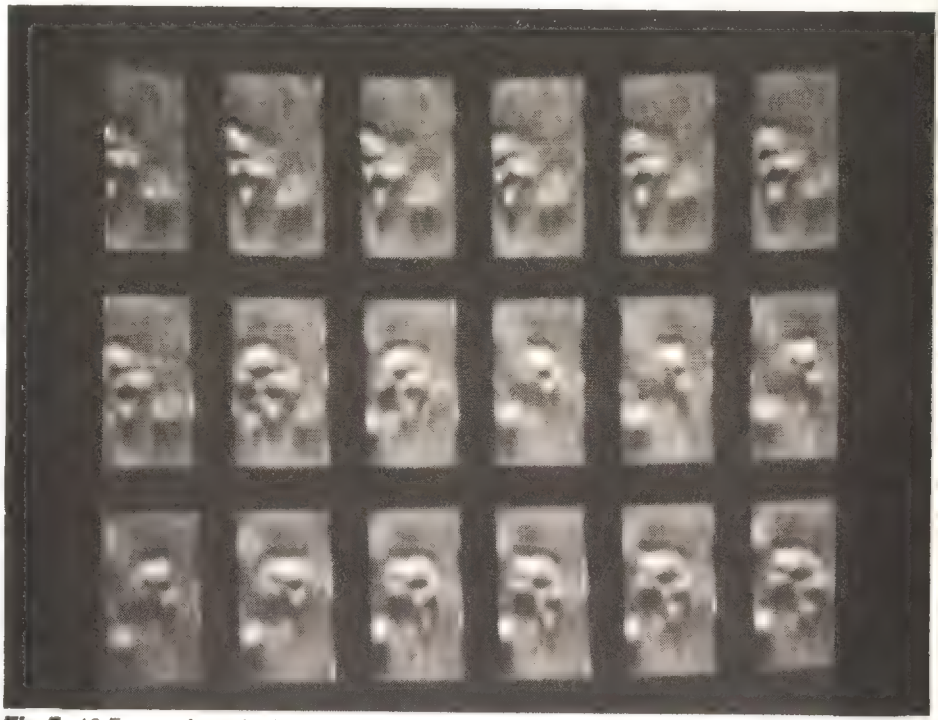


Fig 5 *18 Frames from the March 1928 disc*

'Alive' pictures

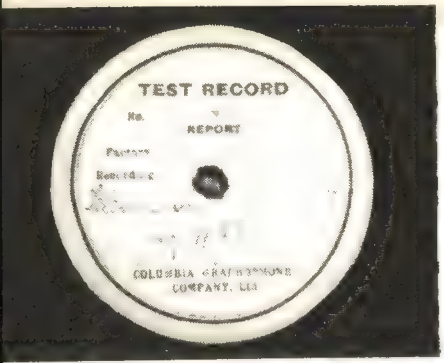
What material did Baird use for these 'video discs'? Although we might expect to see engineering test patterns, we have been treated to pictures of 'live' subjects. One disc (September 1927) *Figure 2*, shows the face of a ventriloquist's dummy moving from side to side. At one point a hand comes into view, covers the dummy's face and quickly disappears. A few seconds later the fingers re-appear, 'waggling' in a life-like manner beside the face.

A recording made a few months later (in January 1928) shows the head of a man. There is very little side-to-side movement and the subject only moves to and from the camera into a pool of light. Lighting in this and the previous recording seems to come from above the subject and is angled steeply downwards. The nose, forehead and chin appear in succession as the face comes into the light. The last feature to come into view is the man's shoulders.

A later disc (March 1928) *Figure 5*, is entitled 'Miss Pounsford' and is signed by Baird himself. This recording does not suffer from the speed variation that plagued the earlier discs. However, the scene is badly distorted by the static pattern already mentioned. Once this effect is removed, the detail and movement become clear showing a view of a lady's head and shoulders. She turns from side-to-side, opens her mouth and shows the ringlets in her hair when she turns her head.

Assessing 'Phonovision'

In order to reproduce 'Phonovision' pictures, the signal from the wax disc is



ig 6 Label of the September 1927 'Phonovi- on' recording

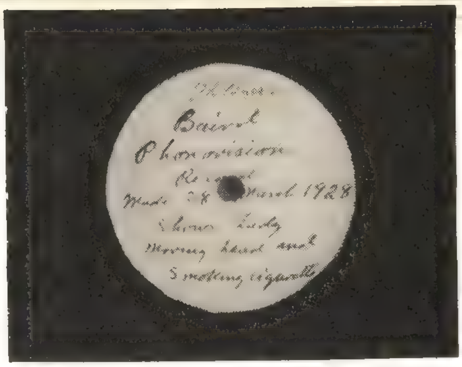


***Fig 7** Label of the March 1928 'Phonovision' recording*

Table 1 — Summary of Features

	Recordings dated 1927-1928	Major Radiovision and its sister disc
Playback speed	250rpm	78rpm
Duration	1 minute	5 minutes
Scene content	Various heads clearly in quite agile motion	Sequences of cartoon stills — no movement
Picture quality	Very poor requiring a lot of enhancement	Extremely good with very little enhancement needed
Identification	Consistent sequence of catalogue numbers	No catalogue numbers
Synchronisation	Directly from turntable rotation	Derived from the video signal

'recorded' into a home computer. A program is then run to remove most of the distortion and the result is shown on a modern TV display. The inherent limitations of a small computer mean that only a few seconds of the recording can be processed at a time, but the capability certainly exists today to process the entire contents of one disc and display the end product as a movie. The cost and effort of the process would, however, be considerable and details of such complex processing are beyond the scope of this article. A more comprehensive account of the methods used in reproducing these pictures was published in the October 1983 issue of 'Wireless World'.

This recent study of historical recordings and their reproduction does not illustrate the power of the computer as much as it emphasizes the poor quality of the recordings. It would not be recommended that the 30-line Baird system is judged by the sole evidence of the wax discs because they were made for test purposes only and are not necessarily representative of what was possible at that time.

Thanks go to T H Bridgewater, W C Fox, R M Herbert, B Clapp, J Ive, D P Leggatt, P Waddell and Mrs Baird for their help in uncovering the secrets of Phonovision.
Don McLean is a Consultant in Image Processing with Logica UK Ltd

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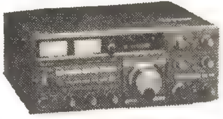

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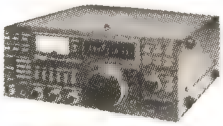

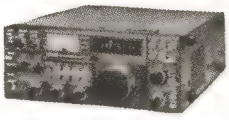

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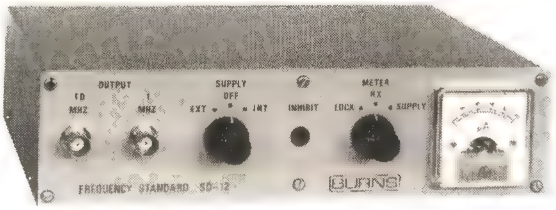

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3. 10W TV Transmit	(As 1 above plus 70FM10 + BDX35)	50.00
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FM Receiver	70FMO5R5	68.15	48.25
Transmitter 6 Channel adaptor	70MCO6T	19.85	11.95
Receiver 6 Channel Adaptor	70MCO6R	27.15	19.95
Synthesiser (2PCB's)	70SY25B	84.95	60.25
Synthesiser Transmit Amp	A-X3U-06F	27.60	17.40
Synthesiser Modulator	MOD1	8.10	4.75
Bandpass Filter	BPF433	6.10	3.25
PIN RF Switch	PSI433	7.10	5.95
Converter (2M or 10M if)	70RX2/2	27.10	20.10
TV Products			
Receiver Converter (Ch 36)	TVUP2	26.95	19.60
Pattern Generator	TVPG1	39.93	32.53
TV Modulator	TVM1	8.10	5.30
Ch 36 Modulator	TVMOD1	10.15	6.95
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Power Amplifiers (FM/CW) Use			
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500mW to 3W	70FM3	19.65	13.25
500mW to 10W	70FM10	30.70	22.10
3W to 10W	70FM3/10	19.75	14.20
10W to 40W	70FM40	58.75	45.20
Combined Power Amp/Pre-Amp	70PA/FM10	46.70	34.65
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3W to 10W (Compatible ATV1/2)	70LIN3/10E	39.10	28.95
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Low Noise, RF Switched	144PA4/S	18.95	14.40
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Piptone	PT3	6.90	3.95
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Relayed Kaytone	PTK4R	9.95	7.75
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Reflectometer	SWR1	6.35	5.35
CW Filter	CWF1	6.40	4.75
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by D R Locke

The unit described here will provide a constant current source for charging batteries up to a voltage of 9v

With the recent greater emphasis on ortable equipment, NiCad batteries are be found more and more. Most battery anufacturers recommend that these atteries are charged from a constant urrent source in order to obtain the best ossible charge condition. The unit escribed here will provide several reset constant currents through cells p to 9V in voltage.

Use of this unit offers a considerable improvement over the familiar constant voltage or series resistor charging systems and thereby aims to ensure an extended working life for the battery.

The circuit

The circuit diagram is given in *Figure 3*. The mains input is stepped down to 12V by transformer T1, rectified by DI–D4 and smoothed by C1 to produce about 14.5VDC at point A. The current/load sensing is carried out by the 7805 regulator (IC1). Capacitor C2 and diode D5 are included to provide stability: if these are omitted, the regulator is likely to oscillate and overheat. Switch S1 switches different values of *R* into the circuit to control the preset current limit.

Charge time with the unit is dependent upon the cell state and capacity but a 1Ah cell charged at 100mA will take about 10

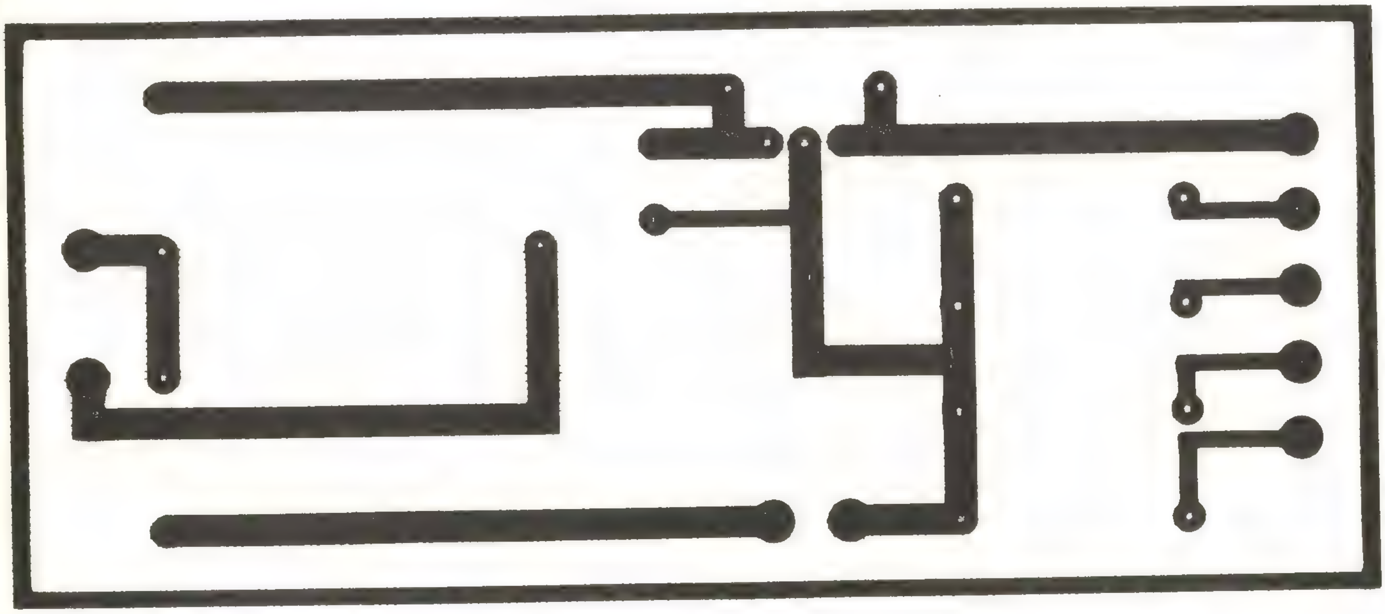

Fig 1 *PCB foil pattern*

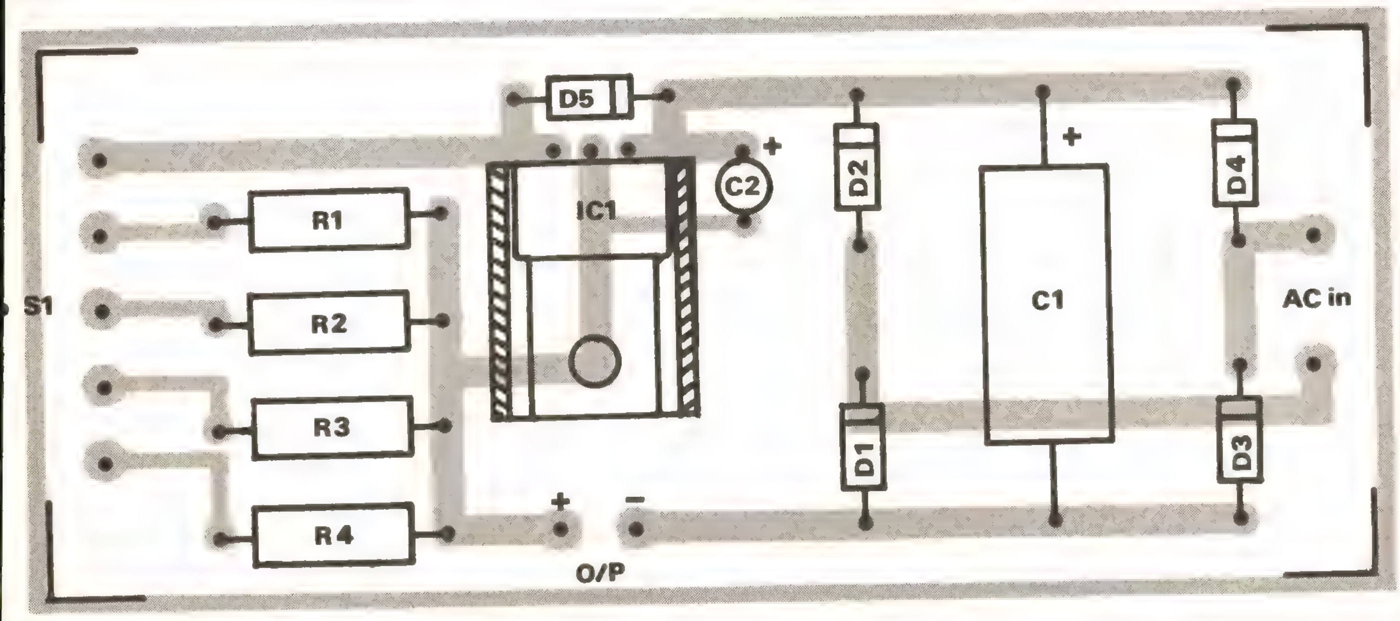

Fig 2 *Component overlay*

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BC238	58-00238	0.08
BC239	58-00239	0.08
BC307	58-00307	0.08
BC308	58-00308	0.08
BC309	58-00309	0.08
BC327	58-00327	0.13
BC337	58-00337	0.13
BC413	58-00413	0.10
BC414	58-00414	0.11
BC415	58-00415	0.10
BC416	58-00416	0.11
BC546	58-00546	0.12
BC550	58-00550	0.12
BC556	58-00556	0.12
BC560	58-00560	0.12
BC639	58-00639	0.22
BC640	58-00640	0.22
MPSA13	58-04013	0.30
MPSA63	58-04063	0.30
ZTX108	58-01108	0.10
ZTX212	58-01212	0.10
2N2904	58-02904	0.25
2N2905	58-02905	0.25
2N3905	58-03905	0.10
2SB646A	58-03646	0.30
2SB648A	58-03648	0.40
2SD666A	58-03666	0.30
2SD668A	58-03668	0.40
2SA872A	58-02872	0.19
2SA1084E	58-01084	0.25
2SA1085E	58-01085	0.25
2SC1775A	58-01775	0.19
2SC2646E	58-02546	0.24
2SC2547E	58-02547	0.24

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BF273	Use BF241	
BF274	Use BF241	
BF362	58-06362	0.49
BF440	58-06440	0.21
BF441	58-06441	0.21
BF479	58-06479	0.66
BF679S	58-06679	0.55
BFR91	58-07091	1.33
BFR96	58-07096	1.45
BFT95	58-10095	0.99
BFW92	58-08092	0.60
BFY90	58-09090	0.90
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MEM680	60-05680	0.75
2SK55	59-01055	0.32
2SK168	59-01168	0.37
3SK45	60-04045	0.49
3SK51	60-04051	0.54
3SK60	60-04060	0.58
3SK81	60-04081	1.32
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BD165	58-15165	0.46
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BD180	58-15180	0.41
TIP31A	58-15031	0.35
TIP32A	58-15032	0.35
MJ2955	58-12955	0.68
2N3055	58-13099	0.58
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2SK135	60-00135	4.25
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MRF472	58-14472	1.25
MRF475	58-14475	4.60
MRF629	58-14629	4.99
PT8811	58-18811	9.50
2SC1945	58-01945	2.60
2SC1971	58-01971	2.49
2SC2053	58-02053	0.63
2SC2097	58-02071	14.75
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VN66AF	60-02066	0.95
ZTX3866	58-03866	0.45
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PW02	12-62006	0.75
SO4	12-24006	0.45
W005	12-10506	0.28
IN4001	12-40016	0.06
IN4002	12-40026	0.07
IN4004	12-40046	0.07
IN4148	12-41486	0.05
IN5404	12-54046	0.16
IN6263	12-62637	0.62

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BA121	12-01215	0.30
BB105B	12-01055	0.30
BB109B	12-01095	0.27
BB204B	12-02045	0.36
BB212	12-02125	1.95
ITT210	12-02105	0.30
MVAM115	Use KV1235	
MVAM125	Use KV1225	
KV1210	12-12105	2.45
KV1211	Use KV1236	
KV1225	12-12255	2.75
KV1235	12-12355	2.75
KV1236	12-12365	2.55
KV1310	12-13105	0.40
KV1320	12-13205	0.40

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MF10	61-00011	5.05
L149	61-00149	1.86
ZNA234	61-02340	8.50
U237B	61-00237	1.28
U247B	61-00247	1.28
U257B	61-00257	1.28
U267B	61-00267	1.28
LM301AH	61-03010	0.98
LM301AN	61-03011	0.44
LM308CN	61-03081	0.65
LM311CN	61-00311	0.46
LM324	61-03240	0.48
LM339N	61-03390	0.68
LM346	61-00346	3.72
LF347	61-00347	1.82
LM348	61-03480	1.26
LF351	61-03510	0.49
LF353	61-03530	0.76
LM380N	61-00380	1.00
LM381	61-00381	1.81
LM382	61-00382	1.81
ZN419CE	61-00419	1.98
ZNA423	61-02430	1.40
ZN425E/8	61-04250	4.50
ZN426E/8	61-04260	3.48
ZN427E/8	61-04270	6.80
ZN428E/8	61-02480	5.50
ZN429E/8	61-04290	2.50
ZN432CJ10	61-04320	29.90
ZN433CJ10	61-04330	24.79
ZN450E	61-04500	7.61
NE542	61-05420	1.20
NE544	61-00544	1.80
NE555N	61-05550	0.21
NE556N	61-05560	0.50
SL560C	61-05600	2.24
NE564	61-00564	4.29
NE565	61-00565	1.00
NE566	61-00566	1.40
NE567	61-00567	1.30
NE570N	61-00570	3.85
uA709HC	61-07090	0.64
uA709PC	61-07091	0.52
uA710HC	61-07100	0.64
uA710PC	61-07101	0.59
uA711CN	61-07110	0.85
uA741CH	61-07410	0.66
uA709PC	61-07411	0.22
uA741CN	61-07470	0.70
uA748CN	61-04780	0.40
uA758	61-00758	2.35
TBA820M	61-00820	0.78
TDA1028	61-01028	2.11
TDA1029	61-01029	2.11
ZNA1034	61-01034	2.10
LM1035	61-01035	4.50
TDA1054M	61-01054	1.46
TDA1062	61-01062	1.95
TDA1072	61-01072	2.69
TDA1074A	61-01074	5.04
TDA1083	61-01083	1.95
TDA1090	61-01090	3.05
HA1196	61-01196	2.00
HA1197	61-01197	1.00
TDA1220	61-01220	1.40
LM1303	61-01303	0.99
MC1310P	61-01310	1.90
MC1330	61-01330	1.20
MC1350	61-01350	1.20
HA1370	61-11370	1.90
HA1388	61-01388	1.75
LM1458N	61-14580	0.45
MC1496P	61-01496	1.25
SL1610	61-01610	2.10
SL1611	61-01611	2.60
SL1612	61-01612	2.10
SL1613	61-01613	2.55
SL1620	61-01620	2.17
SL1621	61-01621	3.50
SL1623	61-01623	3.50
SL1625	61-01625	1.90
SL1630	61-01630	1.62
SL1640	61-01640	3.50
SL1641	61-01641	3.50
MC1648	61-01648	3.25
TDA2002	61-02002	1.25
ULN2240	61-02240	3.25
ULN2242	61-01090	3.05
ULN2283	61-02283	1.00
CA3080	61-03080	0.96
CA3089	61-03089	1.84
CA3123	61-03123	1.40
CA3130E	61-31300	0.80
CA3130T	61-31301	0.90
CA3140E	61-31400	0.46
CA3189E	61-03189	2.20
CA3240E	61-32400	1.27
MC3357	61-03357	2.85
MC3359	61-03357	2.85
ULN3859	61-03859	2.95
KM3701	61-03701	85.53
KM3702	61-03702	74.84
LM3900	61-39000	0.60
LM3909N	61-39090	0.68
LM3914N	61-03914	2.80
LM3915N	61-03915	2.80
KB4400	61-04401	0.90
KB4412	61-04412	1.95
KB4413	61-04413	1.95
KB4417	61-04417	1.80
KB4420B	61-04420	1.09
TDA4420	61-14420	2.65
TDA4421	61-14421	2.86
KB4423	61-04423	2.30
KB4424	61-04424	1.65
KB4430	61-04430	2.30
KB4431	61-04431	1.95
KB4432	61-04432	1.95
KB4433	61-04433	1.72
KB4436	61-04436	1.53
KB4437	61-04437	1.75
KB4438	61-04438	2.22
KB4441	61-04441	1.35
KB4445	61-04445	1.29
KB4446	61-04446	2.75
KB4448	61-04448	1.65
NE5044	61-05044	2.26
MC5229	61-05229	9.60
NE5532	61-55320	2.20
KM5624	61-05624	4.35
SD6000	61-06000	3.75
SL6270	61-06270	2.00
SL6310	61-06310	2.00
SL6600	61-06600	3.75
SAS6610	61-06610	1.48
SL6640	61-06640	2.30
SL6690	61-06690	3.75
SL5700	61-06700	3.20
SAS6710	61-06710	1.48
ICM7555	61-75550	0.98
ICL8038CC	61-08038	4.50
MSL9362	61-09362	1.75
MSL9383	61-09363	1.75
TK10170	61-10170	1.87
TK10321	61-10321	2.75
HA11223	61-11223	2.15
HA11225	61-11225	1.45
HA12002	61-12002	1.22
HA12017	61-12017	0.80
HA12402	61 12402	1.95
HA12411	61-12411	1.20
HA12412	61-12412	1.55
LF13741	61-13741	0.33
MC14412	61-14412	6.85
MK50366	61-50366	3.36
MK50375	61-50375	3.85
MM53200	61 53200	3.90

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Device	Stock No.	1-24
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U265	61-02650	3.16
U266	61-02660	2.43
11C90DC	61-01190	12.95
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MSM5523	61-05523	11.30
MSM5524	61-05524	11.30
MSM5525	61-05525	7.85
MSM5526	61-05526	7.85
MSM55271	61-55271	9.75
ICM7106CP	61-07106	9.55
LC7137	61-07137	7 50
ICM7216B	61-72161	23.95
ICM7216C	61-72162	23.95
SP8629	61-08629	3.85
SP8647	61-08647	6.00
SP8793	61-08793	7.70
HD10551	61-10551	2.45
HA12009	61-12009	6.00
MC12016	61-12016	6.90
HD44015	61-44015	4.45
HD44752	61-44752	8.00
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MC145152P	61-14152	12.30
MC145156P	61-14156	4.60

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Device	Voltage	Stock No.	Price
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7806	+6V	27-78062	0.40
7808	+8V	27-78082	0.40
7812	+12V	27-78122	0.40
7815	+15V	27-78152	0.40
7818	+18V	27-78182	0.40
7824	+24V	27-78242	0.40
7905	−5V	27-79052	0.49
7906	−6V	27-79062	0.49
7908	−6V	27-79082	0.49
7912	−12V	27-79122	0.49
7915	−15V	27-79152	0.49
7918	−18V	27-79182	0.49
7924	−24V	27-79242	0.49
78L05	+5V	27-78050	0.40
78L06	+6V	27-78060	0.40
78L08	+8V	27-78080	0.40
78L12	+12V	27-78120	0.40
78L15	+15V	27-78150	0.40
78L24	+24V	27-78240	0.40
79L05	−5V	27-79050	0.55
78GKC	+adj	27-78993	3.95
78GUIC	+adj	27-78992	1.10
78H05	+5V	27-78054	4.25
78H12	+12V	27-78124	5.45
78HG	+adj	27-78994	7.45
79HG	−adj	27-79994	7.45
LM317MP	+adj.	27-03175	1.75
LM337MP	−adj.	27-03175	1.75
LM317K	+adj.	27-03173	2.35
LM317U	+adj	27-03172	2.15
L200	+adj	27-02006	1.95
uA723	+adj	27-07230	0.85

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1k Lin	48-10213	0.33
5k	48-50213	0.33

Device	Stock No.	Price
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50k Lin	48-50313	0.33
100k Lin	48-10413	0.33
500k Lin	48-50413	0.33
1M Lin	48-10513	0.33
5k Log	48-50214	0.33
10k Log	48-10314	0.33
50k Log	48-50314	0.33
100k Log	48-10414	0.33
500k Log	48-50414	0.33
1M Log	48-10514	0.33
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25k Lin	48-25317	0.67
5k Log	48-50218	0.67
10k Log	48 10318	0.67
25k Log	48-25318	0.67
50k Log	48-50318	0.67
100k Log	48-10418	0.67

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Value	Stock No.	1-24
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250k Lin	48-25415	0.60
1M Lin	48-10515	0.60
1k Log	48-10216	0.60
5k Log	48-50216	0.60
10k Log	48-10316	0.60
25k Log	48 25316	0.60
50k Log	48-50316	0.60
100k Log	48-10416	0.60
250k Log	48-25416	0.60
1M Log	48-10516	0.60

Single gang, pull push DPST switch

Value	Stock No	1-24
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10k Lin	48-10319	0.94
25k Lin	48-25319	0.94
100k Lin	48 10419	0.94
55k Log	48-50220	0.94
10k Log	48-10320	0.94
25k Log	48-25320	0.94
50k Log	48-50320	0.94
100k Log	48-10420	0.94

Dual gang 41 detents primarily for volume controls

Value	Stock No.	1-24
10k Log	48-10322	0.68
100k Lin	48 10421	0.68

Dual gang with click, for tone and balance controls

Value	Stock No.	1-24
50k Lin	48-50323	0.65
100k Lin	48-10424	0.65
100k Balance	48-10425	0.65

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Value	Stock No.	Pk of 10
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2.7pF	04-27901	0.40
3.3pF	04-33901	0.40
3.9pF	04-39901	0.40
4.7pF	04-47901	0.40
5.6pF	04-56901	0.40
6.8pF	04-68901	0.40
8.2pF	04-82901	0.40
10pF	04-10001	0.40
12pF	04-12001	0.40
15pF	04-15001	0.40
18pF	04-18001	0.40
22pF	04-22001	0.40
27pF	04-27001	0.40
33pF	04-33001	0.40
39pF	04-39001	0.40
47pF	04-47001	0.40
56pF	04-56001	0.40
68pF	04-68001	0.40
82pF	04-82001	0.50
100pF	04-10101	0.50
120pF	04-12101	0.50
150pF	04-15101	0.50
180pF	04-18101	0.50
220pF	04-22101	0.50
270pF	04-27101	0.50
330pF	04-33101	0.50

Medium K Ceramic Plate 63VDC

Value	Stock No.	Pk of 10
390pF	04-39102	0.50
470pF	04-47102	0.50
560pF	04-56102	0.50
680pF	04-68102	0.50
820pF	04-82102	0.50
1000pF	04-10202	0.50
1200pF	04-12202	0.50
1500pF	04-15202	0.50
1800pF	04-18202	0.50
2200pF	04-22002	0.50
2700pF	04-27202	0.50
3300pF	04-33202	0.50
4700pF	04-47202	0.50

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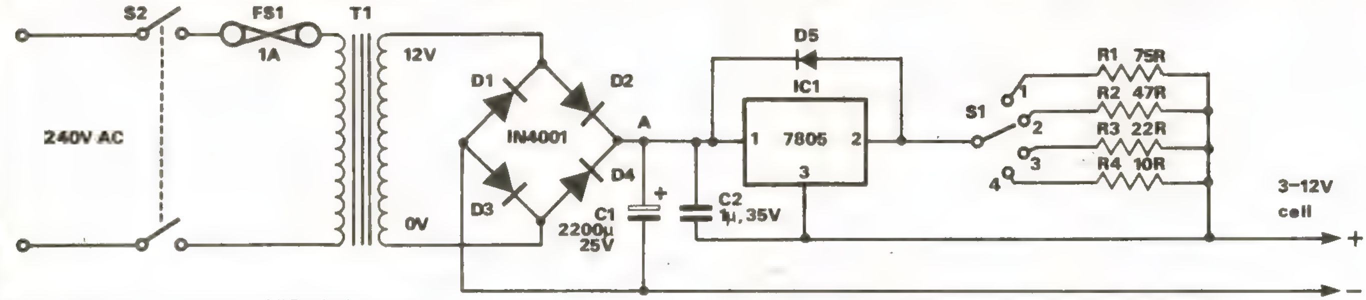
UNIVERSAL NICAD CHARGER



g 3 *Circuit for the universal NiCad charger*

S1 position 1 current limit 66 mA
" 2 " " 100 mA
" 3 " " 250 mA
" 4 " " 500 mA

urs. The manufacturer's information ll give the optimum charging rate for e cell. This should be followed as osely as possible.

onstruction

The prototype unit was constructed in eroboard taking care that the regulator as mounted on a suitable heatsink. aturally, it is also possible to mount the omponents on a PCB, a design for which given in *Figures 1 and 2.* As the egulator case is not connected to round (0V), the case itself cannot be sed as a heatsink unless some suitable nsulating kit is used when mounting the egulator. A suitable heatsink is one of he TV40-type. A 1A fuse is included on he mains supply side of the unit for safety. The wiring is quite straightforward but care should be taken to ensure that the mains wiring is routed well away from the outputs.

The prototype was built in a plastic verobox but any suitable plastic or metal box could be used. If a metal case is used, the case body should be connected to earth.

The regulator itself incorporates overload and overcurrent protection and will start to limit the current at 1A.

PARTS LIST

Resistors

R1	75Ω 0.5W
R2	47Ω 1.0W
R3	22Ω 2.5W
R4	10Ω 2.5W

Capacitors

C1	2200µF 25V
C2	1µF 35V tant.

Semiconductors

IC1	7805 voltage regulator
D1–D5	IN4001

Miscellaneous

A 1-pole 4-way rotary switch; 1 transformer (240V primary; 12V secondary); 1 fuseholder and 1A fuse; 1 veroboard/PCB; a suitable case

The PCB for this project is available from Edwardschild Ltd, 453a Becontree Ave, Dagenham, Essex RM6 6RR at £1.65 each.

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COMMUNICATIONS
BUILDING
BLOCKS

IF AMPLIFIERS-1

LINEAR IF'S FOR AM AND SSB

Intermediate frequency amplifiers tend to be the Cinderella circuits of communications design. Designs can range from the very basic to the outlandish and still provide a similar perceived performance, why?

s and buts

f amplifiers are RF amplifiers operat- g at a fixed single frequency. An IF nplifier may operate between 455kHz (a ry familiar place) and 1.8GHz, it's a atter of the designer's choice. The ctor that is most likely to determine the hoice of IF frequency is likely to involve ome consideration of the filtering quirements of the receiver system ncerned.

In the early days of communication eceiver design, filters were pretty much mited to what could be wrung from L/C nductor and capacitor tuned circuits) ombinations. The famous AR88 and any of its era used very low frequency ntermediate frequencies in order to chieve an acceptable degree of electivity consistent with a reasonable andpass – and centre frequency tability.

Most such sets were inspired by aero r general military applications and the ilitary have always tended to be nsympathetic towards designs that are nly suitable for operation in a domestic nvironment.

Putting these design requirements ogether meant that IF's in the region 0kHz to 100kHz were required, which mmediately pointed out other features f the design, e.g. the image rejection atio of a receiver is only as good as it's F selectivity permits. To differentiate etween 29MHz and it's image at 9.2MHz (assuming a 100kHz IF is in use) equires a degree of RF selectivity that simply cannot be achieved. (Extremes aside).

Q and bandwidth

Assuming a reasonably practical Q factor for the IF tuned circuits (between 150 and 200), there was no alternative available. The problem of image rejection could only be cured by placing the IF at a higher frequency where the wanted and image channel frequencies were more widely spaced. If an IF of 10.7MHz were to be used in the above example, the image frequency would be at (29+21.4MHz), which can be reasonably well avoided by use of the combination of a low pass filter and signal frequency tuned filters in the RF stages.(*Figure 1*) But a Q of 200 at 10.7MHz yields a bandwidth of 53.5kHz: hardly the sort of thing to excite the average SSB enthusiast where 2.4kHz is the norm. A second IF conversion is required to take the result to a more manageable frequency. At 455kHz, a Q of 200 leads to a bandwidth of 2.3kHz at -3dB. This is getting warm, but the formulae relating Q and bandwidth need to be watched carefully (Q=IF centre frequency/IF bandwidth at -3dB), since the shape of the bandpass of a single tuned resonant circuit bears little relation to the ideal bandpass for an AM or SSB signal (*Figure 2*). The receiver IF filter bandpass is a more complex shape (generally the Butterworth) built from multiple pole filtering techniques. Without going into detail, this means that although a 3dB bandpass can be achieved, this does not necessarily imply that the skirt of the bandpass will be acceptable.

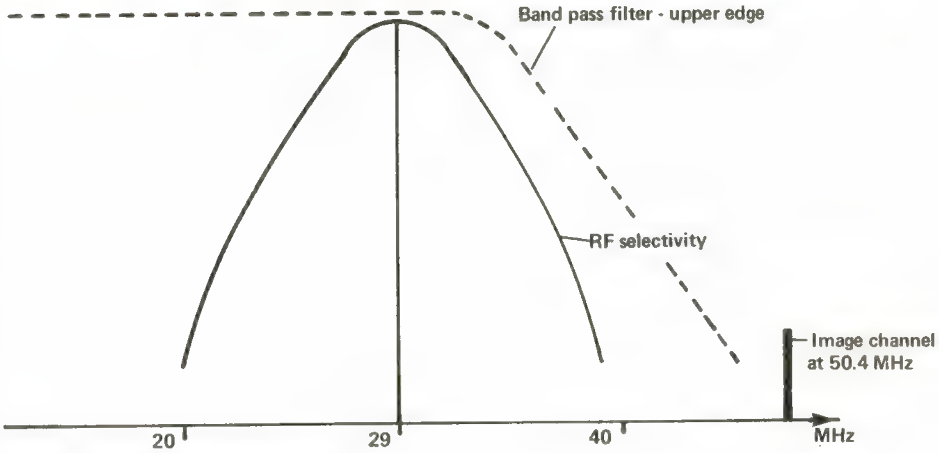

Fig 1 *10.7MHz IF considerations*

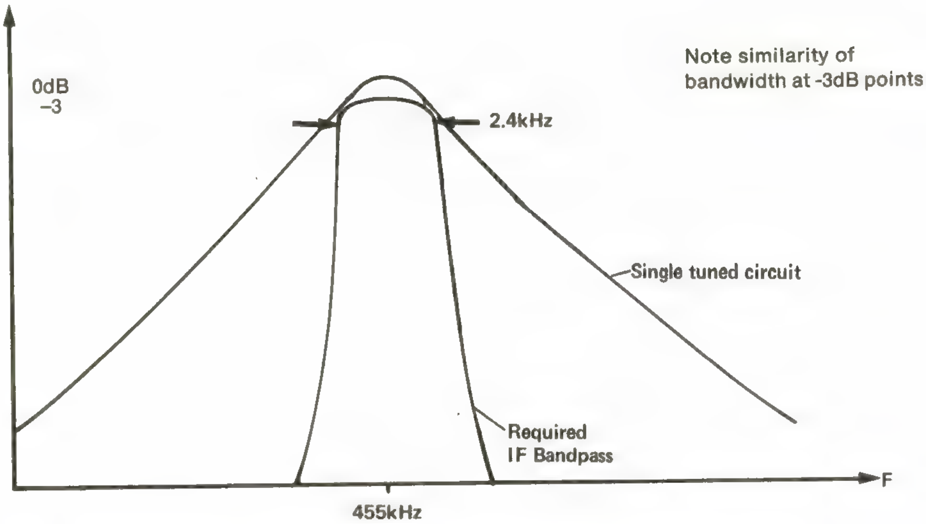

Fig 2 *Required bandpass for AM/SSB compared with single tuned circuit response*

Crystal filters

Modern receiver design has set the IF

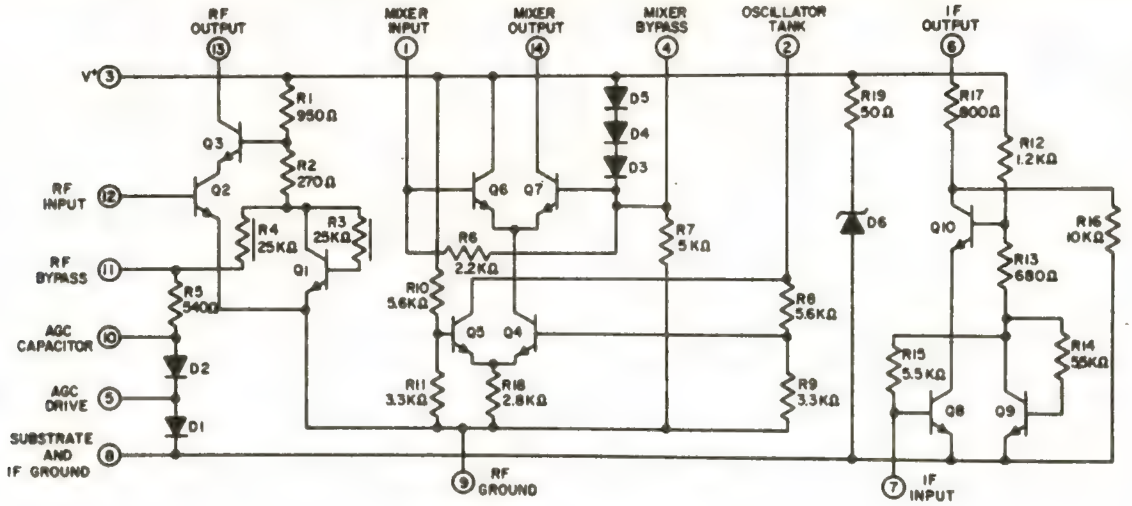

Fig 3a *Diagram of CA3123E*

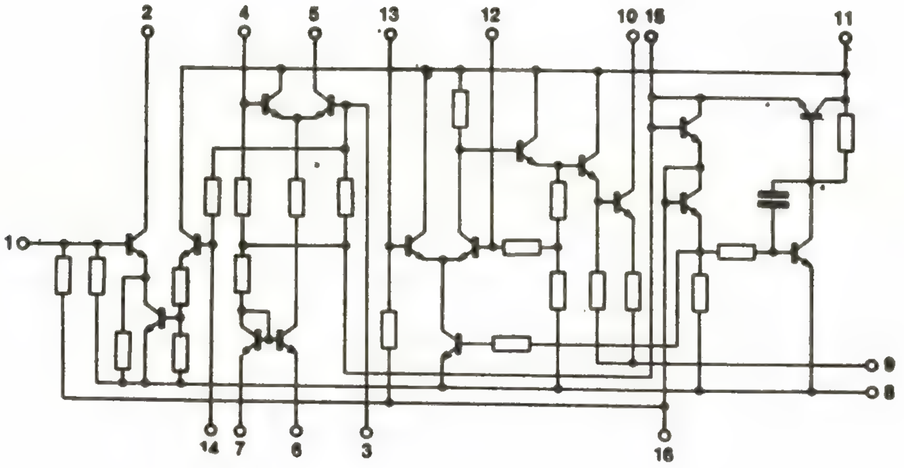

Fig 3b *Diagram of TBA651*

generally above 45MHz. This is almost exclusively due to the improvement in high frequency crystal filters and the corresponding improvement in the price/performance ratio. The advantages of placing the IF at this frequency are many – the most significant being that an image frequency so far removed from the wanted RF signals means that gang-tuned RF selectivity is unnecessary and relatively broadband (bandpass) filters can take its place.

Low cost crystal filters at 45MHz cannot provide more than roofing selectivity (the term widely adopted to mean 'preliminary' selectivity). Even some very expensive ones cannot measure up to the requirements of the modern IF specification, so a second conversion is essential. However, some filters are specifically tailored for use with a second IF of 455kHz and actually drop a carefully construed notch in their bandpass at the image point (45.910kHz).

What's in a frequency?

Not a lot these days. Once again, early IF's were influenced by the way in which valves ran out of steam at higher frequencies, but these days very few semiconductor devices are going to be frequency limited, unless by design. An IF amplifier provides a substantial amount of gain at a single frequency. Anyone with practical experience will confirm that the higher the frequency in use, the more likely are the problems that arise from positive feedback and self-induced oscillation because the impedance of the extraneous path between the input and output inevitably drops as the frequency increases.

This philosophy once led to IF designs that went to some trouble to place a few inches between the input and the output, with the amplifier arranged in a neat line with plenty of screening. However, modern IC's provide less than 10mm in which everything has to happen so techniques have grown up to suit this state o affairs.

Implementations

The original transistor IF amplifie systems are well illustrated by reference to either a cheap transistor radio or a radio control receiver circuit. The 'classic' three transistor IF system is one that has stood the test of time and one that any aspiring communications engineer really ought to try and master by way of experience and penance. The simplest circuits in the world frequently have the most pitfalls. Many millions of exceptionally cheap transistor radios operate with circuits that do not inspire the admiration of the communication engineer but evidently satisfy the requirements of the user.

Integrating this approach has been tried by Texas Instruments – who merely put the discrete packages onto one cheap IC. Needless to say, it suffered the

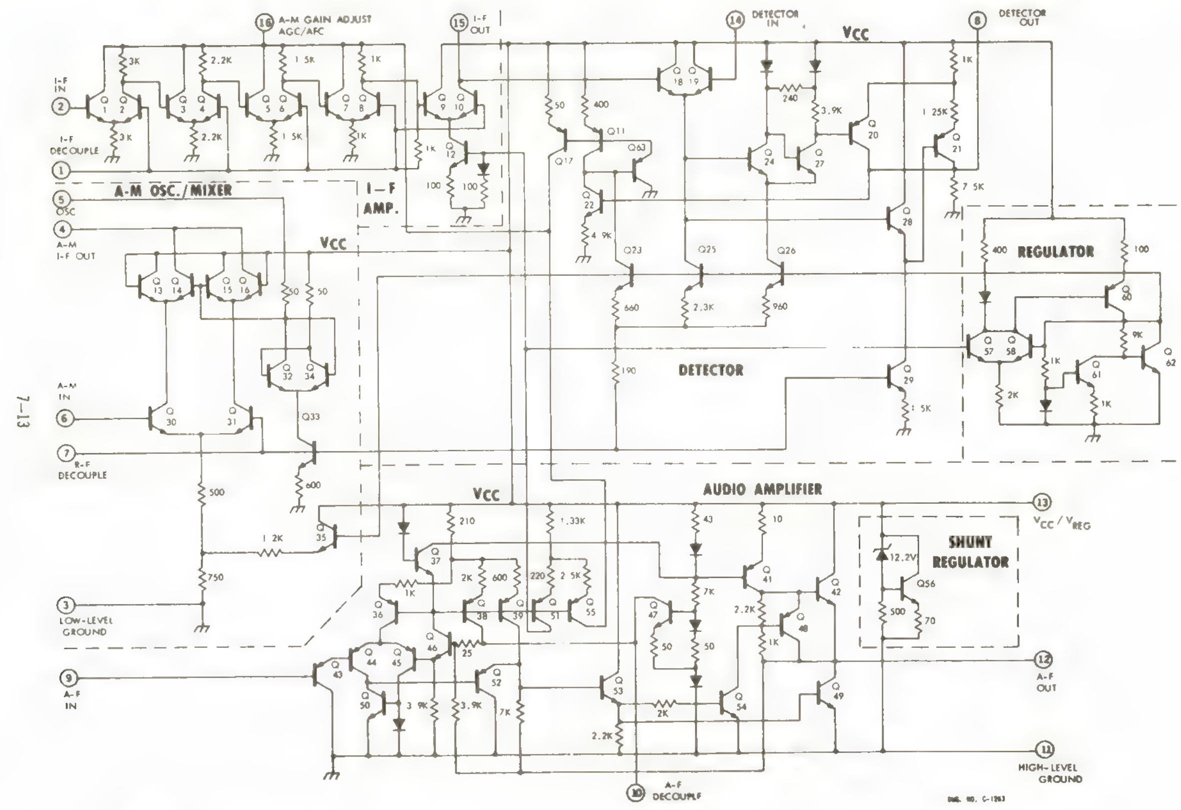

Fig 4a *Inside the ULN2204*

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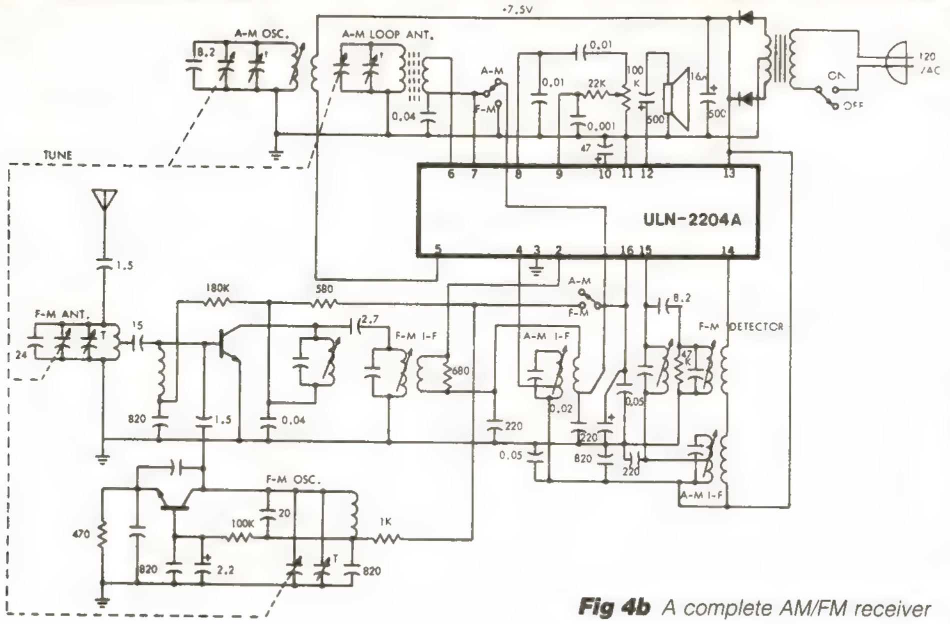

Fig 4b *A complete AM/FM receiver*

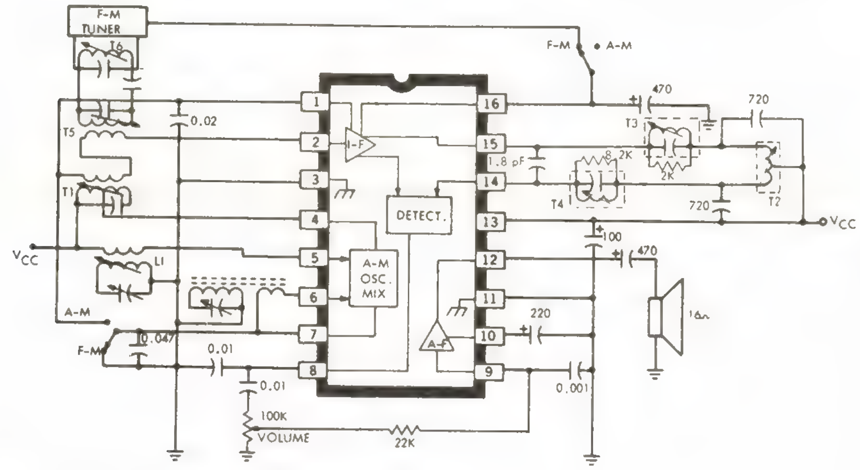

Fig 4c *ULN2204 block detail*

same fate at the hands of serious engineers as its discrete counterpart. SGS produced the TBA651, which enjoyed a period of fashionability along with the CA3123 from RCA (also known as the uA720PC from Fairchild). However, these devices were still little more than the discrete equivalent circuit wrapped into one. *Figures 3a and 3b* illustrate this illustrious pair of devices. Most were configured for linear AM amplification mode, but the IF output voltage was raised to several hundred millivolts in order to drive the detector diode which remained outside the IC's sphere of influence. Many hundreds of millivolts mingled with few microvolts at the input produced a nearly inseparable combination that limited the usefulness of these IC's. A successful applications layout could only be achieved after many attempts, and this led to all sorts of folklore about the impossibility of laying out IC IF stages.

At this stage of development the experienced engineer could still dig out his three-transistor superhet and prove that it worked just as well – so why bother anyway? Good question!

Linearity

Radio signal transmission techniques that rely on using the variation in amplitude as part of the information medium (carrier) naturally require that the receiving end of the system can respond to these variations in a faithful manner. Since antenna signals can vary from a microvolt to a volt, (one million times), the gain of the IF amplifier must compensate for this fluctuation and the technique of automatic gain control (AGC) should be familiar to everyone. AGC is achieved by taking some part of the signal that provides a reference to the overall strength (usually the carrier wave amplitude in the case of amplitude modulation and most SSB) and converting this to a control signal that sets the amplitude of the IF stages (and also the RF stages where used).

One of the most concise applications circuits that describes a 'basic' IF IC provided by national Semiconductor their LM1820 (subsequently updated a the LM3820, details of which are given an associated Databrief in this issue. Th device is a shade more than a discret equivalent and it's necessary to mov along to the generation represented b the ULN2204 (TDA1083) before seein where IF IC design found its niche. Th ULN2204 (*Figure 4a*) implements a goo balanced mixer and then follows throug with a series (*Figures 4b and 4c*) of lon tailed pairs in the IF's whose overall gai is controlled by the collector voltag derived from the detector. Detection i at a relatively low level of IF voltag since the IC itself provides room for a additional gain stage at audio – and ther are no diode voltage drops to b overcome. In this way, the IF gain i stable and manageable.

This device has featured as the soun channel in the original Sinclair Microvision and may easily provide the AM an audio channels in more complex design of communications receiver. Operatio between 100kHz and 30MHz is possible and as such, the ULN2204 is an idea general purpose building block.

Ssb reception

SSB with IC's can be tricky because injecting BFO into the device will almost certainly cause the AGC to be depressed. The best means of injecting a BFO will be to allow the IF IC to run its course of AGC and take some IF signal to a subsequent product detector. A secondary winding on the detector transformer of the ULN2204 yields plenty of signal for subsequent processing, using one of the SL1600 or KB4413 style of devices.

Dynamic range and IF's

Arguably, the IF system is as important as any other link in the signal processing chain. The fact that the bandwidth is considerably narrowed (only at the final conversion, though) means that there are considerably fewer signals to worry about – and those that do get through are going to be the subject of linearisation through the process of AGC.

IF's are a very good place for the experimentally-minded to get in and look around a receiver and its general design. The signal can be taken away by taking some of the IF signal after the final filter. You won't often find that there's much that can be done to improve on the commercial implementation of things like the R2000, R70 etc., but you will be able to get that little bit more familiar with RF if you are intent upon designing your own receiver.

By all means experiment with AGC, time constants and the like – but the main point to bear in mind with the IF is that the fun is in getting them ever smaller and more versatile.

The aspects of design that settle the dynamic range and ultimate sensitivity is just about finished by the output of the first mixer.

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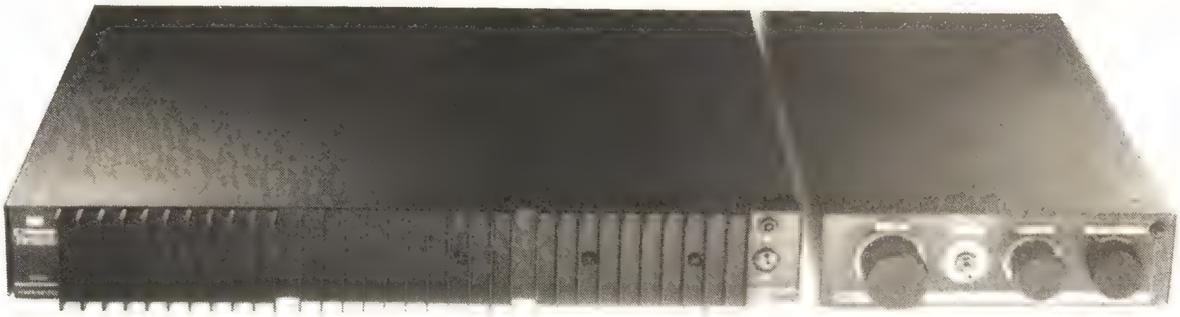

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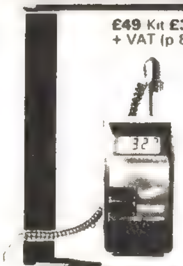

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REAL-TIME CALENDAR CLOCK BASED ON THE R&EW Z8 TBDZ

John Hardaker describes the way in which he uses the R&EW Tiny Basic Development System to tell the time

The *R&EW* Z8 Development System was described by its designer, Jon Burchell, in February '82, March '82 and April '82 issues of the magazine.

Having assembled the Z8671 card into a Vero KM6 rack, connected up the power supply and VDU, and checked that everything was operational, it was considered useful to try reading and writing to an external device. The Hitachi HD 146818P was chosen for this exercise because its data sheet said that it was compatible with 8-bit microprocessors – and because, at around £5, it is not expensive.

The significant features of the 146818 are as follows:

- Counts seconds, minutes and hours of the day
- Counts days of the week, date, month and year
- Automatic end of month recognition
- Automatic leap year compensation
- Three timebase input options: 4.194304MHz; 1.048576MHz; 32.768kHz
- Programmable square-wave output signal
- Clock output may be used as microprocessor clock input either at timebase frequency or at that frequency divided by four
- Multiplexed bus interface circuit
- Binary or BCD representation of time and calendar
- Interfaced with software as 64 RAM locations, comprising 14 bytes of clock and control register and 50 bytes of general purpose RAM

The pin-out of the device is shown in *Figure 1.*

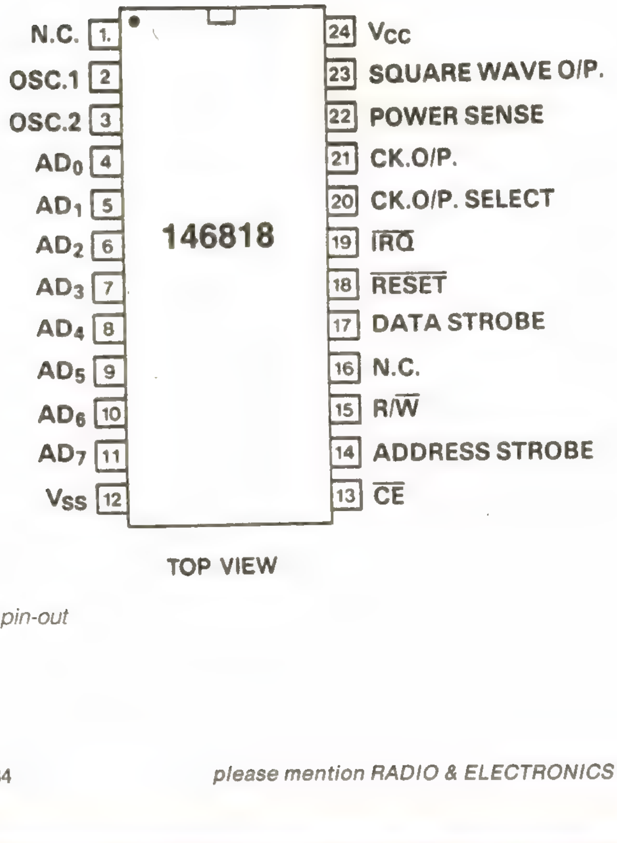

Fig 1 *146818 pin-out*

Putting the idea into practice

Connecting the 146818 to the TBDS board proved simple as only the AS (Address Strobe) line needed inverting.

The resulting circuit, shown in *Figure 4*, was wired with Verowire on a standard Eurocard. However, care had to be taken with the crystal oscillator part of the circuit because this is susceptible to pick-up.

The other point to note is that pin 11 of IC9 on the TBDS board is linked to line a15 on the edge connector of the present circuit. READ or WRITE %4xxx selects this line. The short routine that was written to set up and read the 146818 is shown here as *Program 1.*

Initially, a starting address of %3000 was selected but then the program didn't behave as expected. The reason for this is that, while addresses 1000–2FFF are allocated to RAM, the top of RAM is used for Z8 variable and stack storage. Now, at 'switch on', the microprocessor looks for the top of RAM by looking for an empty address space: thus it is essential that the real-time calendar clock (or, indeed, any such add-on) is placed *non-contiguously* with the Z8 RAM so that it is not 'labelled' as part of main system RAM and is thus 'safe'. The starting address shown here – %4000 – proved quite safe, as is demonstrated by the sample output shown below the program.

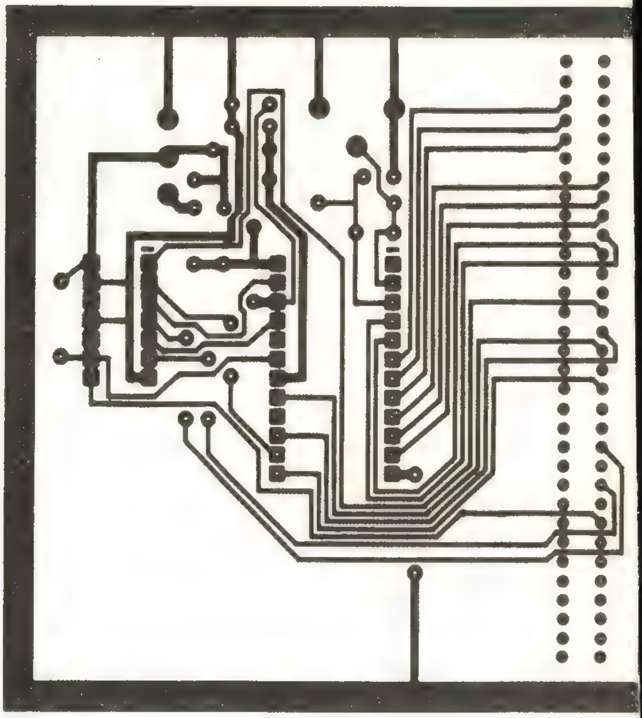

Fig 2 *PCB foil pattern*

Program

```
LIST

10 REM  !   SHORT ROUTINE TO SET UP AND READ THE HD 146818 REAL TIME CLOCK.
20 REM  !
30 REM  !   TYPE RUN TO READ CLOCK AND GOTO 100 TO SET UP.     J.H.H. 7/83
40 REM  !
90 GOTO 320
100 @%400A=%00:@%400B=%80
140 "YEAR";:INPUT A
150 "MONTH";:INPUT B
160 "DATE";:INPUT C
170 "DAY";:INPUT D
180 "HOUR";:INPUT E
190 "MIN";:INPUT F
300 @%4009=A:@%400B=B:@%4007=C
310 @%4006=D:@%4004=E:@%4002=F:@%4000=0
320 @%400B=%16
340 IF @%400C=%90 GOTO 400
350 GOTO 340
400 "    THE TIME IS ";@%4004;" Hrs ";@%4002;" Mins and ";@%4000;" Secs";
410 IF @%4006=1 "    Sunday ";
420 IF @%4006=2 "    Monday ";
430 IF @%4006=3 "    Tuesday ";
440 IF @%4006=4 "    Wednesday ";
450 IF @%4006=5 "    Thusday ";
460 IF @%4006=6 "    Friday ";
470 IF @%4006=7 "    Saturday ";
500 PRINT @%4007;"/";@%4008;"/";@%4009
520 REM  !  LINE 530 IS OPTIONAL
530 GOTO 340
600 STOP


RUN
    THE TIME IS 11 Hrs 28 Mins and 14 Secs   Monday 25/7/83
    THE TIME IS 11 Hrs 28 Mins and 14 Secs   Monday 25/7/83
    THE TIME IS 11 Hrs 28 Mins and 15 Secs   Monday 25/7/83
    THE TIME IS 11 Hrs 28 Mins and 16 Secs   Monday 25/7/83
    THE TIME IS 11 Hrs 28 Mins and 17 Secs   Monday 25/7/83
    THE TIME IS 11 Hrs 28 Mins and 18 Secs   Monday 25/7/83
    THE TIME IS 11 Hrs 28 Mins and 19 Secs   Monday 25/7/83
    THE TIME IS 11 Hrs 28 Mins and 20 Secs   Monday 25/7/83
    THE TIME IS 11 Hrs 28 Mins and 21 Secs   Monday 25/7/83
    THE TIME IS 11 Hrs 28 Mins and 22 Secs   Monday 25/7/83
    THE TIME IS 11 Hrs 28 Mins and 23 Secs   Monday 25/7/83
    THE TIME IS 11 Hrs 28 Mins and 24 Secs   Monday 25/7/83
    THE TIME IS 11 Hrs 28 Mins and 25 Secs   Monday 25/7/83
    THE TIME IS 11 Hrs 28 Mins and 26 Secs   Monday 25/7/83
    THE TIME IS 11 Hrs 28 Mins and 27 Secs   Monday 25/7/83
    THE TIME IS 11 Hrs 28 Mins and 28 Secs   Monday 25/7/83
    THE TIME IS 11 Hrs 28 Mins and 29 Secs   Monday 25/7/83
    THE TIME IS 11 Hrs 28 Mins and 30 Secs   Monday 25/7/83
    THE TIME IS 11 Hrs 28 Mins and 31 Secs   Monday 25/7/83
    THE TIME IS 11 Hrs 28 Mins and 32 Secs   Monday 25/7/83
    THE TIME IS 11 Hrs 28 Mins and 33 Secs   Monday 25/7/83
    THE TIME IS 11 Hrs 28 Mins and 34 Secs   Monday 25/7/83
    THE TIME IS 11 Hrs 28 Mins and 35 Secs   Monday 25/7/83
    THE TIME IS 11 Hrs 28 Mins and 36 Secs   Monday 25/7/83
    THE TIME IS 11 Hrs 28 Mins and 37 Secs   Monday 25/7/83
    THE TIME IS 11 Hrs 28 Mins and 38 Secs   Monday 25/7/83
    THE TIME IS 11 Hrs 28 Mins and 39 Secs   Monday 25/7/83
    THE TIME IS 11 Hrs 28 Mins and 40 Secs   Monday 25/7/83
    THE TIME IS 11 Hrs 28 Mins and 41 Secs   Monday 25/7/83
    THE TIME IS 11 Hrs 28 Mins and 42 Secs   Monday 25/7/83
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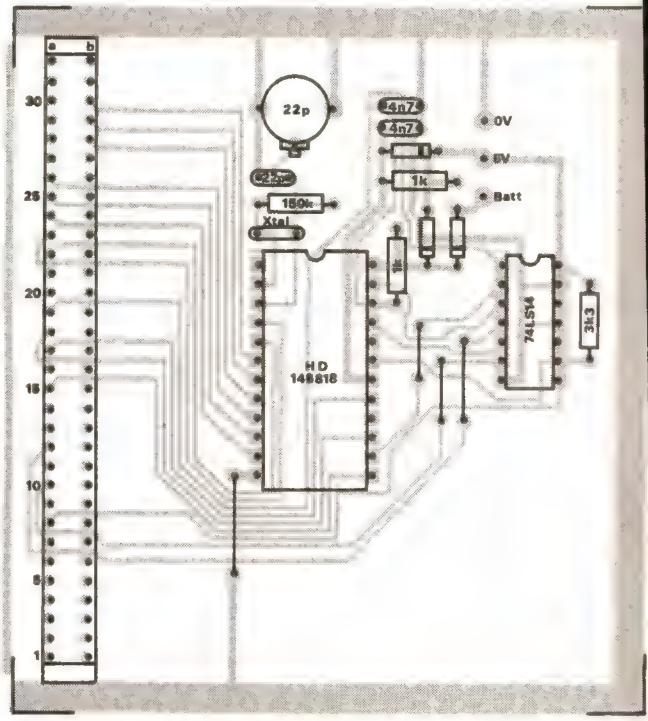

Fig 3 *Component overlay*

Computers, Communications and Applications

A brief survey of the current trends in the use of computers, in which we discuss those of interest to the radio amateur

aming to love the micro

R&EW readers tend to regard compu- rs as the work of the devil. Suggestions e made to the effect that if readers ant to read about computers, then iere's fifty plus magazines on the ookstall that deal solely with that ubject and little else. Whilst this is true, ou won't find much relevant to amateur adio in the computer magazines, and ie problem seems to be that once a adio enthusiast gets bitten by the omputing bug, too easily they can isappear off the communications scene hilst exploring their new interests. If ie' then writes any software pertinent to mateur radio, then we'd certainly like to ear about it!

We attempt here to reveal the rele- ance of computing to the communica- ions enthusiast, to see if we cannot ncourage a more rational view of the ubject, and to get some software and ardware published that is of positive enefit. With the present bottomless arket for arcade games (now supported y a top twenty chart much like the pop ecord scene), don't hold your breath for anyone else to come up with the goods or the communications enthusiasts....

Humbug

Love them or hate them, computers are unavoidable in any aspect of modern life. But what can you do with one?

There's not much chance that you can escape the computer revolution for long. Current estimates place some 2 million machines in the hands of the great British public. The ZX Spectrum and ZX81 have run away with first prize, scoring around a half million each in the past year, and even if you don't own one yourself, the chances are that you know someone that does.

By understanding more of what they can do, you can perhaps try and persuade your computer obsessed friends to divert their skills and efforts to writing some software to perform a communications task or two. Indeed, the writer of this piece took a while to learn to love the microcomputer. The secret seems to be finding out what you can actually do with one that is relevant to your interests.

Is there life after space invaders?

The fad for arcade 'action' games seems to have got the home computer off to a bad start where the radio amateur is concerned. There really has been distressingly little serious application software published that is relevant to the communications enthusiast. The fact is that virtually any of the present generations of small personal computers offer the chance to expand the interests of the computer enthusiast in any number of ways: as they say in the ads., only limited by your imagination!

Are people who claim to be sick of computers actually confessing to having a lack of imagination? Or is that the marketing of the hardware has not yet bothered to address itself to the relatively specialised concerns of us communications enthusiasts as long as there's a remarkably bottomless pit of people willing to spend their lives chasing block graphics around the phosphors.

The more specialist programs that are published as listings require typing – and that's another skill that must be acquired if you are to master the art – and you'll be doing yourself no favours to settle for anything less than a real keyboard.

CW, RTTY, AMTOR and SSTV made easy

Communications using computers is a very natural extension of the CW and RTTY that have long been part of the hobby. Sending ASCII data files across the airwaves is relatively simple, and the better high resolution machines offer plenty of scope for slow scan TV and other forms of picture transmissions: you can even send circuit diagrams, PCB plotting details: in fact, anything the computer can send 'internally' on pieces of wire can be serialised and broadcast – albeit at a somewhat slower speed due to the bandwidth limitations on the low frequency bands. Move up to UHF and SHF and your transmissions can be as fast as you like.

The hardware for computer aided RTTY and CW (HAL, Tono etc) has been around a while, yet it is quite possible to do both by writing your own software for most of the more popular computers. It's a shame that there aren't many programs published which point this out. Packet switched networks have grown from Canada, through the US and are at last being talked about in the UK.

So what's the catch?

When someone coined the phrase 'language' for computer instructions sets, they hit the nail squarely on the head. If you don't understand the language of computing, then its like trying to net on 40m amongst a group of Latvians speaking their local dialect.

The conversation could be about the most riveting topics imaginable, someone could be offering to pin a £10 note to his QSL cards – but you wouldn't know a thing about it. Moreover – and here's the rub – you wouldn't care a whole lot either. Learning a language is a tiresome business, best done when you are relatively young and have the patience for such tasks. If you don't speak computerese, then you don't know what you are missing.

The next catch in this process of familiarisation is the simple fact that there is no substitute for buying a machine – which is quite a hurdle if you don't actually believe that you are interested in the subject. It's hard to part with £200 if you imagine you are going to be bored with the results. Reading books is nearly impossible as a means of absorbing computing – like languages, you have to practise expressing yourself, and seeing if you are understood. It's called programming.

Tailor made

Most commercial communications software emanating from the US (from Kantornics and others) is written primarily for the Apple, which although the US market leader, lags a long way behind in the UK as a result of the implementation of a dollar/pound policy. Thanks to the fragmentation of the marketplace, the Sinclair Spectrum and BBC computer are not yet widely accepted in the USA. The Spectrum sold in the USA bears little relation to the UK product, anyway.

Diversionary tactics

The communications enthusiast must be well aware that a lot of the new blood is being diverted into computing at present. The peak computer buying market is in the 15-18 year and 27-32 year age brackets, which is the same as seen in the average amateur radio event.

However, amateur radio and computers do not appear to mix. Lowe Electronics have tried to blend the two when they started handling the Video Genii, but they quickly discovered that the two markets were poles apart and separated their operations into two distinct divisions.

The US amateur radio magazines go to some pains to print programs and applications, yet they are some way behind the UK in terms of computer numbers in the home. There's a superb feature article in the May 1983 issue of QST titled 'Designing Narrow Band-Pass Filters with a BASIC Program' – a classic example of computing with a purpose. When did anyone last see that sort of feature in one of the popular personal computer magazines?

More programs for designing radios

There's a brilliant new program being offered by Number One Systems of St Ives for modelling circuit characteristics using either a BBC or Spectrum computer. You may recall the review we ran on Harcourt systems sophisticated 'Circuit Modeller' package for CP/M systems. CP/M systems are not generally found in the home, but BBC's and Spectrums certainly are, so here's an ideal applications program that helps you to design active circuits – 'it' even designed the GHz front end of the new Meteor range of frequency counters offered by Black Star. Costing about £35 it will accurately model the gain, phase and frequency characteristics of most types of circuit encountered in linear design. This is only just the start of a wave of serious enthusiasts applications software that will begin to make the radio amateur sit up and think about computers.

Yet more

The graphics capabilities of personal computers has already led to applications software for the BBC computer that emulate storage oscilloscopes, and this is only a start. It takes little computing effort to devise an interface that will produce a spectrum analyser display, calibrate the frequency and amplitude axes, and build up a pattern of band usage by storing signals and their characteristics for later recall and analysis.

The use of colour displays can provide a lot more useful information to help separate the information – and sooner or later someone is going to find out what goes on behind those promising interface sockets on every new rig that hits the dealers' shelves. We've already seen one application to control an Icom R70 and provide on-screen information with a BBC computer. So what – there's knobs for that anyway.

The same computing can provide the CW and RTTY display, frequency management by searching the band for a clear channel to call, taking into account the band plan in force...the possibiliti are endless, and we'd very much like hear from readers with ideas so that can begin to gather some useful so ware. There's also an opportunity for t experienced amateurs to get their han on some new 1984 computers to imp ment communications based progra and thus try and bring their more retice colleagues along with the revolution.

Signs of the times

One of the most disturbing aspects the past year in amateur radio has be the relative decline of interest bei shown by the youngsters who have be trapped by computing. Yet the opport nities for enhancing the hobby both circuit design and station operati offered by computing are more obviou than in most other pastimes whe computing can be 'applied'.

If the gardeners can use computers help them grow their beans, what keeping the radio fraternity from gettin inside the technology and application Radio and Electronics World would li to spearhead the growing awareness, s let's have your views please.

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ALSO

Superb range of two metre antenna. An essential asset for the serious DX man

High quality 'performance' antenna backed by a full two year's guarantee. Made in England so your valuable pounds don't go abroad into foreign pockets! Full spares availability.

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The economical and portable beam.
6 elements boom length 63.5" weight 0.7 kilo wind load area 0.5 sq.ft. gain 9dbd beamwidth 50° connector S0239 Also in portable form. Complete with clamps and plug shroud.

Tiger LY8 £19.50
For the operator who wants both high performance and compact size.
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Tiger LY10 £32.95
For the discerning DX man who wants only maximum performance at the lowest price!

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HAVE YOU THOUGHT OF BECOMING AN AUTHOR?

We are always interested in receiving articles to be considered for publication and are particularly keen to hear from anyone who has something to say related to the amateur radio field. As mentioned before, projects for fellow readers to build are most welcome.

You don't need to be an expert writer. If you can get your ideas down on paper, preferably typed, with drawings that we can follow and photographs where relevant, we will sort out the style, grammar, spelling etc.

If you have an idea for an article, or have designed and built a project that you think others would be interested in, but still have doubts about becoming an author, why not write (giving brief details and your *telephone number)* or telephone Dennis Hayes . . . and of course you will be paid for your effort.

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8" Disk Drives
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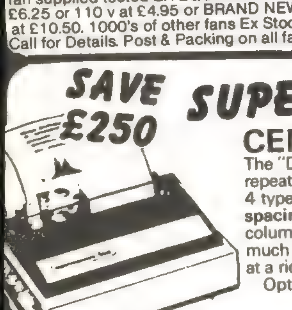

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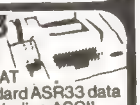

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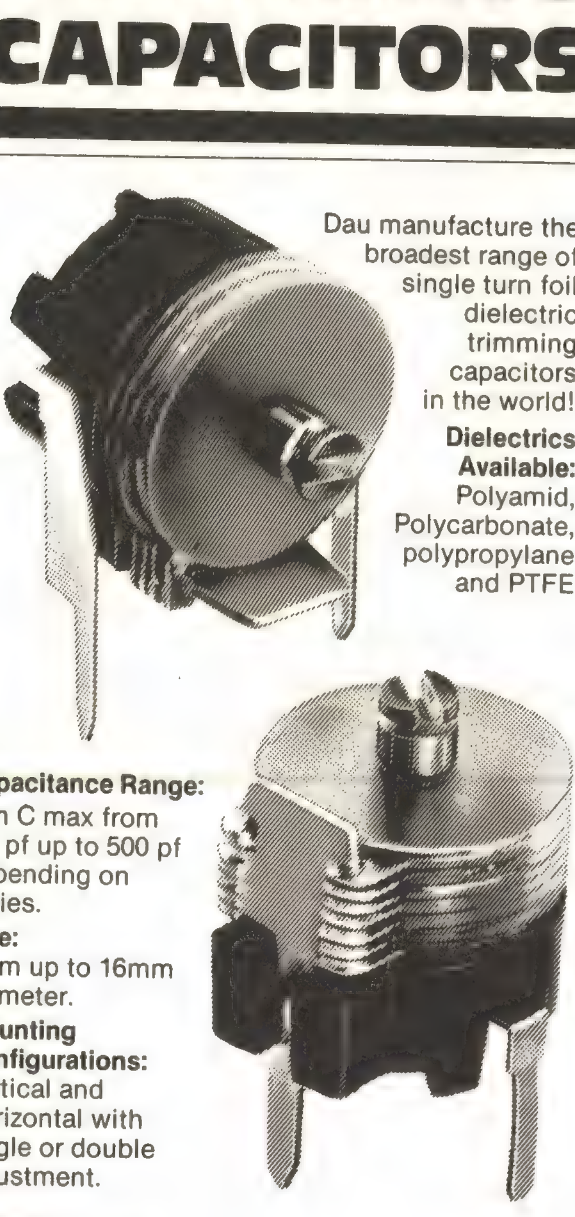

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SAS570S	1.75
SAS580	2.85
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SL917B	6.65
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SL1327	1.10
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SN76003N	1.95
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SN76110N	0.89
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SN76226DN	1.55
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TA7205AP	1.80
TA7222AP	1.80
TA7227P	4.25
TA7310P	1.80
TA7313AP	2.95
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TAA700	1.70
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TBA120C	1.15
TBA120T	1.05
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TBA520Q	1.10
TBA530	1.10
TBA530Q	1.10
TBA540	1.25
TBA540Q	1.35
TBA550Q	1.45
TBA560C	1.45
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TBA641A12	2.50
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TBA920Q	1.65
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TBA990Q	1.49
TBA1441	2.15
TCA270	1.10
TCA270SQ	1.10
TCA650	2.50
TCA800	2.15
TCA940	1.65
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UPC1032H	1.50
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556	0.42
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741	0.35
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AC127	0.20
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AC128K	0.32
AC141	0.28
AC141K	0.34
AC142K	0.30
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AC176K	0.31
AC178	0.28
AC187	0.25
AC187K	0.28
AC188	0.25
AC188K	0.37
AD142	0.79
AD143	0.82
AD149	0.70
AD161	0.39
AD162	0.39
AD161/2	0.90
AF114	1.50
AF124	0.34
AF125	0.35
AF126	0.32
AF127	0.32
AF139	0.40
AF178	1.95
AF239	0.42
AU106	2.00
AU107	1.75
AU110	2.00
AU113	2.95
BC107A	0.11
BC107B	0.11
BC108	0.10
BC108A	0.11
BC108B	0.12
BC109	0.10
BC109B	0.12
BC109C	0.12
BC114	0.11
BC116A	0.15
BC117	0.19
BC119	0.24
BC125	0.25
BC139	0.20
BC140	0.31
BC141	0.25
BC142	0.21
BC143	0.24
BC147	0.09
BC147B	0.09
BC148A	0.09
BC148B	0.09
BC149	0.09
BC157	0.12
BC158	0.09
BC159	0.09
BC160	0.28
BC161	0.28
BC170B	0.15
BC171	0.09
BC171A	0.10
BC171B	0.10
BC172	0.10
BC172B	0.10
BC172C	0.10

BC173B	0.10
BC174	0.09
BC174A	0.09
BC177	0.15
BC178	0.15
BC182	0.10
BC182LB	0.10
BC183	0.10
BC183L	0.09
BC184LB	0.09
BC204	0.10
BC207B	0.13
BC208B	0.13
BC212	0.09
BC212L	0.09
BC212LA	0.09
BC213	0.09
BC213L	0.09
BC214	0.09
BC214C	0.09
BC214L	0.09
BC237	0.10
BC237A	0.09
BC237B	0.09
BC238	0.09
BC239	0.12
BC251A	0.12
BC252A	0.15
BC258	0.25
BC258A	0.39
BC284	0.30
BC300	0.30
BC301	0.30
BC303	0.26
BC307	0.09
BC307A	0.09
BC307B	0.09
BC327	0.10
BC328	0.10
BC337	0.10
BC338	0.09
BC347A	0.13
BC461	0.35
BC478	0.20
BC527	0.20
BC547	0.10
BC548	0.10
BC549A	0.08
BC550	0.08
BC557	0.08
BC557A	0.08
BC557B	0.08
BC558	0.10
BCY33A	1.60
BD115	0.30
BD116	0.60
BD124P	0.59
BD131	0.32
BD132	0.35
BD133	0.40
BD135	0.30
BD136	0.30
BD137	0.32
BD138	0.30
BD139	0.32
BD140	0.30
BD144	1.10
BD159	0.65

BD166	0.55
BD179	0.72
BD182	0.70
BD201	0.83
BD202	0.65
BD203	0.78
BD204	0.70
BD222	0.46
BD223	0.46
BD225	0.46
BC232	0.35
BD233	0.35
BD234	0.35
BD236	0.45
BD237	0.40
BD238	0.40
BD241	0.40
BD242	0.50
BD246	0.60
BD376	0.32
BD410	0.55
BD434	0.65
BD437	0.60
BD438	0.60
BD506	0.50
BD508	0.40
BD520	0.65
BD538	0.65
BD597	0.75
BD697	1.10
BD698	1.10
BD707	0.90
BDX32	1.50
BDY57	1.65
BF115	0.35
BF127	0.24
BF154	0:12
BF158	0.22
BF160	0.27
BF167	0.24
BF173	0.22
BF177	0.38
BF178	0.26
BF179	0.34
BF180	0.29
BF181	0.29
BF182	0.29
BF183	0.29
BF184	0.28
BF185	0.28
BF194	0.11
BF195	0.11
BF196	0.11
BF197	0.11
BF198	0.16
BF199	0.14
BF200	0.40
BF241	0.15
BF245	0.30
BF246	0.28
BF256/LC	0.28
BF257	0.28
BF258	0.28
BF259	0.28
BF271	0.26
BF273	0.13
BF336	0.34
BF337	0.29
BF338	0.32
BF355	0.37

BF362	0.38
BF363	0.38
BF371	0.20
BF394	0.19
BF422	0.32
BF457	0.32
BF458	0.36
BF459	0.36
BF595	0.23
BF597	0.25
BFR39	0.23
BFR40	0.23
BFR41	0.28
BFR81	0.25
BFR88	0.30
BFR90	1.50
BFR91	1.75
BFT42	0.28
BFT43	0.28
BFW92	0.85
BFX29	0.30
BFX84	0.26
BFX85	0.32
BFX86	0.30
BFX88	0.25
BFY50	0.21
BFY51	0.21
BFY52	0.25
BFY90	0.77
BLY48	1.75
BR100	0.26
BR101	0.30
BRC4443	0.85
BT106	1.49
BT108	1.89
BT116	1.20
BT119	1.65
BT120	1.65
BU105	1.22
BU108	1.69
BU124	1.25
BU125	£1.25
BU126	1.60
BU204	1.55
BU205	1.30
BU208	1.39
BU208A	1.52
BU326	1.20
BU407	1.24
BU500	2.25
BU526	1.90
BUY69B	1.70
MJ3000	1.98
MJE340	0.40
MJE520	0.48
MPSA12	0.20
MPSA13	0.20
MPSA92	0.30
MRF450A	12.50
MRF453	17.50
MRF454	23.50
MRF475	2.50
MRF477	10.00
OC23	1.50
OC42	0.55
OC44	0.75
OC45	0.55
OC70	0.45
OC71	0.40
OC81	0.50

R2008B	1.70
R2010B	1.70
R2322	0.58
R2323	0.66
R2540	2.48
RCA16334	0.90
RCA16335	0.80
SKE5F	1.45
TIP29	0.40
TIP29C	0.42
TIP30C	0.43
TIP31C	0.42
TIP32C	0.42
TIP33B	0.75
TIP34B	0.75
TIP41A	0.45
TIP41C	0.45
TIP42C	0.47
TIP47	0.65
TIP120	0.60
TIP125	0.65
TIP142	1.75
TIP146	2.75
TIP161	2.95
TIP2955	0.80
TIP3055	0.55
TIS91	0.20
TV106/2	1.50
2N2219	0.28
2N2905	0.40
2N3053	0.40
2N3054	0.59
2N3055	0.52
2N3702	0.12
2N3703	0.12
2N3704	0.12
2N3705	0.12
2N3706	0.12
2N3708	0.12
2N3773	1.95
2N3792	1.35
2N4427	1.50
2N4444	1.15
2N5294	0.42
2N5296	0.48
2N5298	0.60
2N5496	0.65
2SA715	0.60
2SC495	0.80
2SC496	0.80
2SC1096	0.80
2SC1172Y	2.20
2SC1173	1.15
2SC1306	1.00
2SC1307	1.50
2SC1449	0.80
2SC1678	1.25
2SC1945	2.10
2SC1953	0.95
2SC1957	0.80
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2SC2028	1.15
2SC2029	1.95
2SC2078	1.45
2SC2091	0.85
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3N211	1.95

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AA119	0.08
BA102	0.17
BA115	0.13
BA145	0.16
BA148	0.17
BA154	0.06
BA155	0.13
BA156	0.15
BA157	0.30
BAX13	0.04
BAX16	0.06
BB105B	0.30
BT151	0.79
BY126	0.10
BY127	0.11
BY133	0.15
BY164	0.45
BY176	1.20
BY179	0.63
BY182	0.55
BY184	0.35

BY199	0.40
BY206	0.14
BY208-800	0.33
BY210-800	0.33
BY223	0.90
BY298-400	0.22
BY299-800	0.22
BYX10	0.20
BYX36-150R	0.20
BYX38-600R	0.60
BYX55-600	0.30
BYX71-600	0.60
BZY95C30	0.35
OA47	0.09
OA90	0.05
OA91	0.06
OA95	0.06
OA202	0.10
IN914	0.04
IN4001	0.04
IN4002	0.04
IN4003	0.04

IN4004	0.05
IN4006	0.05
IN4006	0.06
IN4007	0.06
IN4148	0.02
IN4448	0.10
IN5401	0.12
IN5402	0.14
IN5403	0.12
IN5404	0.12
IN5405	0.13
IN5406	0.13
IN5407	0.16
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ECC83 Mullard/ Brimar U.K.	1.35
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ECC91	2.00
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ECC189	0.78
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ECC804	0.60
ECC807	2.50
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ECF200	1.85
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ECH84	0.69
ECH2000	1.50
ECL80	0.60
ECL82	0.65
ECL83	2.50
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ECL85	0.69
ECL86	0.80
ECL805	0.69
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EF94	0.85
EF95	1.00
EF97	0.90
EF98	0.90
EF183	0.65
EF184	0.65
EF730	1.80
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EF732	1.80
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EF805S	13.50
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EL34 Philips	3.15
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EL37	9.00
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EL41	3.50
EL42	2.00
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EL82	0.58
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EL91	6.00
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PC88	0.75
PC92	3.50
PC97	1.10
PC800	1.10
PC900	1.25
PCC84	0.40
PCC85	0.54
PCC88	0.70
PCC89	0.70
PCC189	0.70
PCC805	0.70
PCC806	0.80
PCE82	0.80
PCF80	0.65
PCF82	0.60
PCF84	0.65
PCF86	1.20
PCF87	0.40
PCF200	1.80
PCF201	1.80
PCF800	0.40
PCF801	1.35
PCF802	0.60
PCF805	1.25
PCF806	1.00
PCF808	1.25
PCH200	1.50
PCL82	0.80
PCL83	2.50
PCL84	0.85
PCL85	0.80

PCL86	0.85
PCL200	1.80
PCL800	0.80
PCL805	0.90
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PL81	0.72
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PL82	0.80
PL83	0.52
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PY81	0.70
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PY83	0.70
PY88	0.65
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QQZO3-20	42.50
QQZO6-40A	45.25
QS72/20	1.50
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QS150/30	1.15
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QS1203	4.15
QS1205	3.95
QS1206	1.05
QS1207	0.90
QS1208	0.90
QS1209	2.00
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QS1211	1.50
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U193	0.65
U251	1.00
U291	0.60
U801	0.75
UABC80	0.65
UAF42	1.00
UBF80	0.60
UBC41	1.75
UBC81	1.50
UBF89	0.60
UBL21	1.75
UC92	1.20
UCC84	0.70
UCC85	0.60
UCF80	1.00
UCH21	1.20
UCH41	1.20
UCH42	1.35
UCH81	0.65
UF85	1.20
UF41	1.15
UF42	1.15
UF80	0.80
UF89	2.50
UL41	3.50
UL84	0.85
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XC15	1.50
XC25	0.50
XE3P	2.50
XFW47	1.50
XFW50	1.50
XG5-500	22.50
XL1-5V	1.50
XNP12	2.50
XNP28	2.50
XP1002	29.00
XR1-1600A	49.50
XR1-3200A	79.50
XR1-6400A	99.50
XSG2-0	3.00
Y63	1.50
Y65	6.95
Y602	12.00
YJ1060	265.00
YL1020	29.00
YL1070	115.00
YL1071	109.00
YL1370	5.50
YL1371	6.50
Z77	1.20
Z302C	12.00
Z303C	9.00
Z505S	15.00
Z520M	4.00
Z521M	8.00
Z700U	3.00
Z749	0.60
Z759	19.85
Z800U	3.00
Z801U	3.00
Z803U	16.95
ZA1000	12.50
ZA1001	1.50
ZA1002	1.50
ZC1040	8.00
ZM1000	12.50
ZM1001	5.00
ZM1005	8.00
ZM1020	5.95
ZM1021	8.00
ZM1023	7.95
ZM1041	14.00
ZM1050	14.00
ZM1082	9.00
ZM1084	10.00
ZM1177	9.00
ZM1202	55.00
ZM1263	4.00
ZM1612	3.00
1AC6	1.20
1B3GT	1.95
1B5	2.50
1B22	10.00
1B24	14.95
1B35A	29 50
1C1	1.20
1C5GT	1.00
1D5	1.00
1FD1	0.90
1G3GT	1.00
1L4	0.80
1L6	1.50
1LA6	1.00
1N5GT	2.50
1S2	0.55
1T4	0.45
1U5	1.00
1X2B	1.15
2C21	1.00
2C39A	23.50
2C39BA	39.50
2C40	37.00
2C40A	55.00
2C42	29.50
2C43	29.50
2C51	0.75
2C53	32.00
2B7	1.50
2D21	0.95
2D21W	2.50
2E26	7.95
2J42	93.00
2K25	24.95
3A/107B	12.00
3A/109B	11.00
3A/110B	12.00
3A/141K	11.50
3A/147J	7.50
3A/167M	10.00
3A2	3.95
3A3A	3.95
3A4	1.10
3AL5	0.95
3AT2	3.35
3AW2	3.35
3B2	3.00
3B7	4.50
3B24	7.50
3B28	12.00
3C4	1.00
3C45	24.00

3CN3A	2 50
3CX3	2.50
3D21A	29.50
3D22	19.50
3J187E	398.00
3J187G	398.00
3W4GT	2.50
4B551B	115.00
4-65A	59.00
4-250A	95 00
4C27	25.00
4C28	25.00
4CX250B I T T	37.50
4CX250B EIMAC	58.00
4CX250B surplus ex-government	12.50
4CX250B tested ex-equipment	6.00
4CX250R	48.50
4CX350A	71.50
4GS7	2.25
4GV7	2.25
4J52	75.00
4X150A	25.00
5A152M	9.00
5A163K	10.00
5A170K	6.25
5AN8	1.20
5AR4	2.00
5AU4	1.50
5B 110M	10.00
5B-254M	14.50
5B-255M	14.50
5B-257M	9.00
5B-258M	14.50
5C22	40.00
5R4GB	2.80
5R4GY	2.80
5U4G	1.00
5U4GB	2.50
5V4G	1.25
5Y3GT	0.80
5Z4GT	0.85
6/30L2	0.70
6A/203K	9.00
6A8G	1.50
6AB7	0.70
6AB8	0.65
6AC7	2.00
6AF4A	2.50
6AG5	1.50
6AG7	1.95
6AH6	1.50
6AJ4	2.00
6AJ7	2.00
6AK5	1.00
6AK6	2.00
6AL5	0.60
6AM4	3.25
6AM5	6.00
6AM6	1.50
6AN5	3.95
6AN8A	2.15
6AQ5	1.20
6AQ8	0.85
6AR5	2.00
6AR8	2.00
6AS5	1.50
6AS6	1.50
6AS7G	7.50
6AT6	0.75
6AT8	1.75
6AU4	2.00
6AU6	0.85
6AV6	0.75
6AW8A	2.95
6B8G	1.50
6BA6	0.69
6BA6W	1.50
6BA7	4.50
6BA8A	3.50
6BC8	1.00
6BD4	1.50
6BD6	1.00
6BE6	0.72
6BF5	1.80
6BG6G	2.50
6BH6	1.95
6BH8	1.50
6BJ6	1.20
6BK4	4.00
6BK7A	1.95
6BM8	0.58
6BN4	1.65
6BN6	1 65
6BN7	4.50
6BN8	2.75
6BQ5	0.75
6BQ7A	0.72
6BL7GTA	3.95
6BL8	0.65
6BR5	0.70
6BR7	4.95
6BR8	2.15
6BR8A	2.15
6BS7	5.50
6BS8	2.50
6BW4	1.50
6BW6	5.35
6BW7	1.50

6BW8	4.00
6BX6	0.48
6BX7GT	3.50
6BZ6	2.50
6BZ7	2.95
6BZ8	0.95
6C4	1.10
6C5	1.95
6C6	0.50
6C8G	1.50
6C11	2.50
6C15	2.50
6C18	2.50
6CA4	0.80
6CA7	4.50
6CB6	1.95
6CD6GA	4.50
6CF6	1.50
6CH6	10.35
6CL6	3.50
6CL8A	2.00
6CM5	1.60
6CS6	0.75
6CW4	7.25
6CY5	1.00
6DC6	2 95
6DK6	1.15
6DQ5	3.35
6DQ6B	2.50
6EA8	2 50
6EB8	1.75
6EU8	1.75
6EW6	1.50
6F1	2.00
6F6G	2.00
6F12	1.50
6F13	3.00
6F14	1.00
6F17	2.75
6F18	1.50
6F19	0.48
6F21	2.50
6F22	0.70
6F23	0 60
6F24	1.25
6F25	1.25
6F28	1.25
6F33	17.00
6FG5	1.95
6GH8A	0.80
6GK5	1.50
6GK6	2.00
6GV7	2.50
6GW6	2.50
6H3N	1.10
6H6	1.35
6H6GT	1.20
6J4	1.10
6J4WA	3.15
6J5	1.95
6J5GT	1.50
6J6	0.65
6JB6A	3.95
6JE6C	3.95
6JS6C	3.95
6K7G	0.70
6K8Y	3.95
6KD6	5.50
6L1	2.50
6L19	3.95
6L6GC	2.95
6L6GT	1 15
6L7G	0.75
6LD20	0.60
6LF6	4.50
6LQ6	4.50
6N7	2.50
6N7GT	1.50
6P15	1.50
6P25	4.00
6P28	2.00
6Q7	1.20
6Q7GT	1.20
6S4A	1.50
6S7	1.10
6SA7GT	1.00
6SC7	1 50
6SG7	1 20
6SH7	1.20
6SJ7GT	1.20
6SK7	0.80
6SK7GT	1.20
6SL7GT	0 85
6SN7GT	0.69
6SQ7	0.80
6SS7	1.95
6U4GT	1.75
6U5G	1.50
6U8	0.85
6U8A	1.60
6V6GT	0.85
6X2N	1 00
6X4	0.90
6X5GT	0.55
6X5GTY	1.00
6X8A	2.25
7A7	2.00
7AD7	1.75
7B7	2.50
7C5	3.00
7C6	2.50
7H7	2.00
7Q7	2.00
7S7	3.00
7Y4	1.95
8B8	2.50

8FQ7	1.95
10C1	5.50
10C2	0.70
10D2	1.25
10F1	0.75
10GK6	1.95
10P14	2.50
10P18	0.78
10LD11	1.00
10LD12	0.65
11E2	16.50
11E3	55.00
12AE6	0.85
12AG8	1.50
12AL5	1.00
12AT6	0.65
12AT7	1.15
12AT7WA	2.50
12AU6	1.50
12AU7	0.55
12AV6	0.80
12AX4GT	1.00
12AX7	0.65
12AX7WA	2.50
12AYZ	4.00
12AZ7A	1.95
12B4A	3.50
12BA6	1.50
12BE6	1.05
12BH7A	1.80
12BL6	1.75
12BY7A	2.75
12CX6	1.20
12E1	17.95
12E14	28.00
12GN7	3.95
12HG7A	3.95
12J7GT	0.70
12K5	1.00
12K7GT	0.60
12K8	1.10
12Q7GT	0.50
12SA7GT	1.00
12SH7	1.00
12SK7	1.00
12SJ7	0.60
12SN7GT	1.85
13D3	3.20
13D7	3.20
13DR7	2.95
13E1	115.00
14S7	1.00
17DW4A	1.75
17EW8	0.95
17JZ8	2.75
18D3	1.60
19AQ5	1.15
19G3	17.00
19H4	23.95
19Q6	9.00
20A2	10.50
20D1	0.70
20D4	1.75
20LF6	3.50
20L1	0.95
20P1	0.55
20P3	0.80
20P4	1.05
20P5	1.15
21LU8	2 50
25L6GT	1.75
25BQ6	1.75
29C1	19.50
30	2.85
30C1	0.70
30C15	0.40
30C17	0.40
30C18	1.48
30F5	0.95
30FL1	1.00
30FL2	1.35
30FL12	0.95
30FL13	1.10
30FL14	1 25
30L1	0.45
30L15	0.60
30L17	0.60
30P4MR	1.00
30P12	1.00
30P18	0.60
30P19	1.00
30PL1	2.50
30PL13	0.60
30PL14	1.75
31JS6A	4.15
35A5	4.50
35L6GT	2.00
35W4	0.70
35Z3	1.85
38HE7	4.50
40KD6	5.50
47	6.00
50B5	1.50
50C5	0 95
50CD6G	1.15
50JY6	2.95
52KU	2.00
61SPT	4.50
75B1	2.50
75C1	2.95
83A1	7.00
84	3.00
85A1	6.50
85A2	2.00
90AV	10.00
90C1	2.70

90CG	13.50
91AG	9.00
92AG	12.50
92AV	12.50
95A1	6.50
108C1	1.50
150B2	5.50
150C2	1.50
150C4	2.15
155UG	25.00
185BT	1.50
205F	12.00
257A	6.00
307	5.00
329	5.00
388A	17.50
425A5	8.00
431U	2.00
572B	35.00
705A	8.00
708A	8.00
715A	6.00
715C	45.00
725A	275.00
803	14.95
805	39.00
807	1.50
810	55.00
811A	12.95
813	18.50
813 USA	59.50
833A	115.00
866A	3.50
872A	19.00
873	60.00
884	5.50
954	0.50
955	0.90
958A	0.90
1299A	0.60
1625	3.00
2050W	9.50
2050	7.00
3545	4.00
4313C	4.00
5642	8.50
5651	3.20
5654	1.95
5663	1.95
5670	3.25
5672	4.50
5675	23.50
5687	4.50
5692	3.50
5696	3.50
5704	3.50
5718	6.50
5725	2.50
5726	2.50
5727	2.50
5749	2.50
5750	2.00
5751	3.50
5763	4.95
5814A	3.25
5840	3.50
5842	11.00
5879	3.90
5881A	4.60
5894	39.50
5899	4.50
5963	2.00
5965	2.25
5993	8.00
6005	1.95
6012	16.00
6021	3.95
6057	2.50
6059	3.75
6060	2.25
6062	4.50
6063	2.00
6064	3.25
6067	1.95
6072	4.20
6080	5.75
6080WA	8.50
6096	2.85
6132	10.00
6136	2.50
6146B	7.50
6201	6.95
6211	2.50
6267	1.50
6350	2.00
6360	5.80
6386	14.50
6545	8.50
6550A	8 00
6870	11.50
6883B	9.95
6973	3.75
7025	2.50
7027A	4.95
7032	2.00
7059	2.50
7189	2.50
7199	3.95
7247	2.00
7360	9.50
7475	6.00
7551	5.75
7558	11.50
7581A	3.00
7586	11.50
7591A	5.50
7609	47 00
7868	3.95
8012	15.00
8136	1.00
8298A	4.95
8417	5.95
9001	0 90
9006	0.90
18042	10.00
18045	10.00

WIREWOUND RESISTORS

PREFERRED VALUES

4 Watt	4R7-1K8	0.15
	2K2-6K8	0.18
	10K	0.24
7 Watt	R47-4K7	0.18
	5K6-12K	0.19
	15K-22K	0.20
11 Watt	1R-10K	0.20
	15K-22K	0.24
17 Watt	1R-10K	0.26
	15K-22K	0.28

WW-2

BASES ETC.

B7G	0.15
B7G Skirted	0.30
B8G	0.70
B9A	0.20
B9A Skirted	0.30
B10B	0.16
B13B	0.50
8 Pin DIL	0.14
14 Pin DIL	0.15
14 Pin DIL/Q	0.30
16 Pin DIL	0.17
OCTAL	0.35
CANS	0.27
B9A PCB	0.15
B5	0.75
B9G	0.38

ZENER DIODES

BZX61 0.15

6V2 7V5 8V2 9V1 10V 11V 12V 13V
15V 16V 18V 20V 22V 24V 27V 30V
33V 36V 39V 47V 51V 56V 68V 75V

BZY88 0.07

2V7 3V 3V3 3V6 3V9 4V3 4V7 5V1
5V6 6V2 6V8 7V5 8V2 9V1 10V 11V
12V 13V 15V 18V 20V 24V 27V 30V

THERMISTORS

VA1040	0.23
VA1056S	0.23
VA1104	0.70
VA8650	0.45
VA1097	0.25

BATTERIES

7V Power Mike batteries
TR175 £1.40 ea
other prices on request

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R&EW Data Brief MC1377

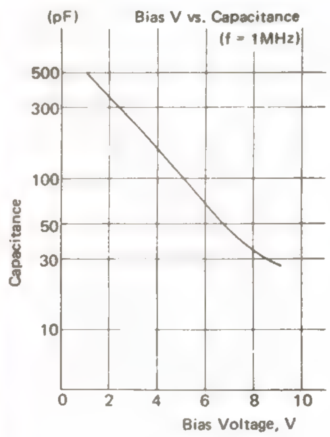
VARICAPS FOR HF & VHF

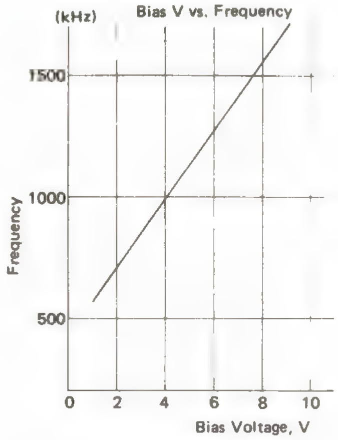
Electrical Characteristics
9V Series (Ta = 25°C)

Item	Symbol	Characteristics			Unit	Condition
		Min.	Typ.	Max.		
Reverse Voltage	V_{BR}	20	–	–	Vdc	$I_R = 10\mu A$
Leakage Current	I_R	–	–	100	nAdc	$V_R = 15V$
Capacitance	C_{1V}	445	490	535	pF	$V_R = 1V$, f = 1MHz
Capacitance	C_{9V}	–	25	–	pF	$V_R = 9V$, f = 1MHz
Cap. Ratio	C_{1V}/C_{9V}	16.9	–	23.5		f = 1MHz
Capacitance Tolerances	$\triangle C$	–	–	2.5	%	(3 Unit) $V_R = 1V$
		–	–	2.0	%	(2 Unit) $V_R = 1V$
		–	–	0.3pF+3	%	(3 Unit) $V_R = 9V$
		–	–	0.3pF+2	%	(2 Unit) $V_R = 9V$
Q	Q	200	–	–		$V_R = 1V$, f = 1MHz
Temp. Coef.	TC_Q	–	500	–	PPM/°C	$V_R = 5V$, f = 1MHz

Classification	Rank	C_{1V}	C_{9V}
Classification	Rank X	C_{1V} = 445~500pF,	C_{9V} = 23.6pF (Typ.)
	Rank Y	C_{1V} = 480~535pF,	C_{9V} = 25.3pF (Typ.)

9V Series





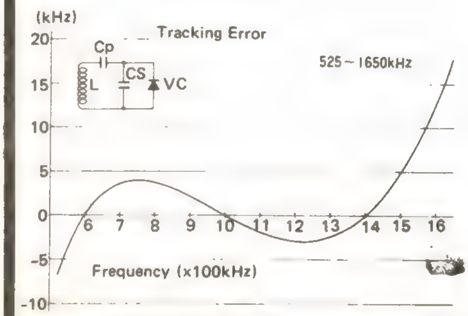
(Rank X)

Cp = 479		(pF)	Typ.	Lower	Upper
C_{MAX}		(pF)	474	450	498
C_{MIN}		(pF)	23.7	26.5	21.7
ANT	CS	(pF)	24.4	18.7	29.3
	L	(μH)	189.2	200	179.9
OSC	CS	(pF)	36.2	31.5	39.9
	L	(μH)	107.9	111	105.2

(Rank Y)

Cp = 511		(pF)	Typ.	Lower	Upper
C_{MAX}		(pF)	506	482	530
C_{MIN}		(pF)	25.3	28.3	23
ANT	CS	(pF)	26.1	20.1	31.3
	L	(μH)	177.3	186.8	169
OSC	CS	(pF)	38.6	33.7	42.7
	L	(μH)	101.1	103.8	98.7

Tracking Error



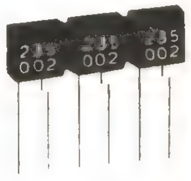
The widespread use of frequency synthesis technology in the consumer radio field has seen a rapid development of varicap diodes designed to provide a wide capacitance swing with a relatively small voltage swing. Early varicaps that provided 20:1 capacitance swing were very expensive – £5 was about average.

However, TOKO who are better known for coils than varicaps saw the opportunity opening up with frequency synthesis and have developed a range of low cost wide range varicaps that provide all the necessary features of high Q, wide capacitance range (with low minimum capacitance), and accurate matching.

The last of the above features is vital to ensure good matching between stages – although the up-conversion process coupled with wideband front-end technologies is gradually replacing multiple-ganged tuned circuits.

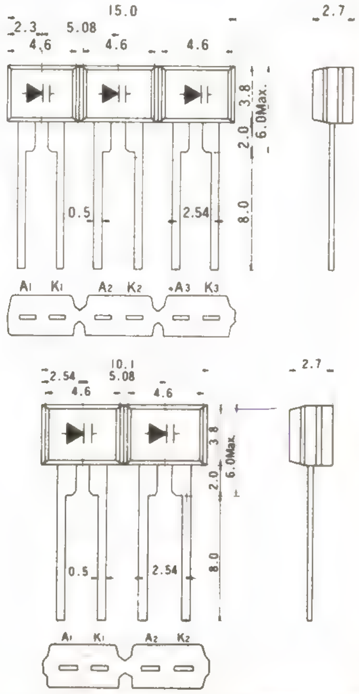
The general rule is to use the largest voltage swing available, since compress

2 Unit Choco-Break.



3 Unit Choco-Break

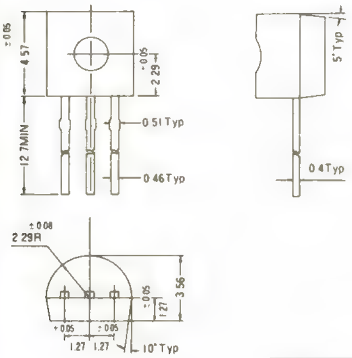
Dimensions/Pin Assignment



for FM Radios

DIMENSIONS

(Unit=mm)



ing the capacitance swing over a small voltage swing means that the tuning voltage must be exceptionally pure and free from interference. Notwithstanding this, TOKO are shortly introducing a 4.5V version of the KV1235, which should do away with the need for DC-DC conversion in low powered portable synthesised radios. Battery portables do not suffer from hum and other mains borne problems.

Points to watch

When using a varicap, remember that the Q of the tuned circuit it is controlling depends on the dynamic resistance of the circuit. Feeding the tuning voltage to a varicap with a low value resistor will damp the circuit in the same way as if the resistor had been connected directly across it. But by keeping this resistor as a very high value, you are providing a very high impedance line that will be susceptible to hum pickup.

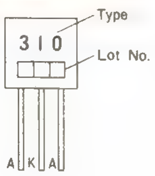
Care is needed in laying down a varicap tuned circuit to extract the best performance – oscillator circuits must be particularly carefully considered to avoid extraneous FM, and unnecessary noise from an overall Q that is too low.

MAXIMUM RATINGS

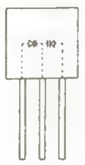
Ta=+25℃

Item	Symbol	Rating	Unit
Reverse Voltage	V_R	18	V
Forward Current	I_F	50	mA
Power Dissipation	P_D	100	mW
Operating Temperature	Topr	−55～+80	℃
Storage Temperature	Tstg	−55～+125	℃

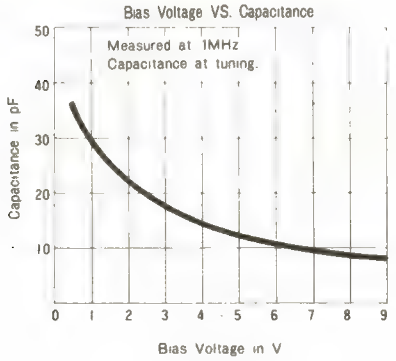
BLOCK DIAGRAM

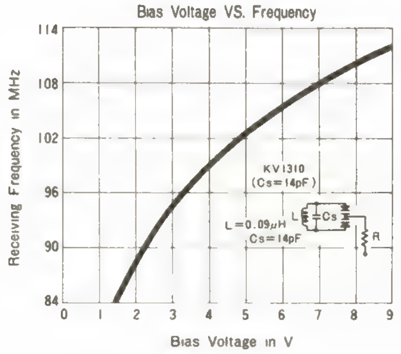


PIN ASSIGNMENT



CHARACTERISTIC CURVES





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Item	Symbol	Characteristics		Unit	Condition
		Min.	Max.		
Reverse Voltage	V_{BR}	16		V	I_R=10μA
Reverse Current	I_R		100	nA	V_R=10V
Capacitance (2V)	C_{2V}	76.50	97.98	pF	V_R=2V、f=1MHz
Do. (4V)	C_{4V}	52.51	69.97	pF	V_R=4V、f=1MHz
Do. (6V)	C_{6V}	38.25	50.96	pF	V_R=6V、f=1MHz
Do. (8V)	C_{8V}	32.01	42.64	pF	V_R=8V、f=1MHz
Inter-terminal Capacitance Tolerance	ΔC		3	%	V_R=2、4、6、8V、f=1MHz
Series Resistance	rs		0.5	Ω	V_R=2V、f=70MHz
Capacitance Variation Ratio	A	2.0	2.8		C_2/C_8、f=1MHz

NOTES : 1. Capacitances are given for back-to-back connections. In use, the capacitance values will be one/fourth (1/4).
2. Capacitance measured with YHP 4275A, or equivalent; level, 30mV ±5mVrms
3. Series Resistance measured with YHP-4191A, or equivalent.

POINT OF CONTACT

In order to facilitate ready contact between radio amateurs, ***Radio & Electronics World*** will publish a monthly updated list of licensed readers, including some of the bands they favour, approximate times and days of the week when they operate and a few other details.

If you wish to be included in this scheme, would you please complete and return the form below and send to: ***Radio & Electronics World***, Sovereign House, Brentwood, Essex CM14 4SE.

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.... Postcode.....................

Telephone No .... Call Sign................................... Date licensed...........................

Type of Licence A....................☐ B....................☐

Bands usually preferred ....

Operating days M T W T F S S Times ....

Equipment ....

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Special interests eg DX,AMSAT etc...

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Most interesting contact made to date ....

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NOTES FROM THE PAST

We learn how twentyfive and more years ago here was considerable controversy on whether adio amateurs were really amateurs if they used ommercial equipment instead of building their wn. That there ever was such a controversy may be a surprise to many of our readers.

The other topic concerns the silly claim that ne particular scientist was the "inventor of radio"

When the Russians first came up with e story that Popov was the 'inventor of dio' – as if it could have been invented y one man! – it was mildly amusing. As e claim became more and more equently made, apparently to make ure nobody missed it, it became ritating. Nowadays it seems to be npossible to find any Russian-inspired ublication which fails to repeat the laim, usually with reports of celebraons and homages in honour of the nventor of radio – A S Popov'. pparently they have borrowed a page rom Goebbels text-book and hope that y repeating the same story enough imes it will eventually become accepted s true.

Personally, I can scarcely recall hearg of Popov's work until the Russians ery belatedly 'discovered' him a few ears back. He died over a half-century go and very little can be found about im in reference books. Like all decalent democrats I learned to accept that cientists and physicists of many natonalities shared in the discovery and levelopment of the knowledge that nabled Marconi to successfully underake his practical work.

Possibly Popov did add something of alue, or he may have even made some ital discovery independently without knowing he had been preceded, but if so e seems to have been mightily secreive about it. To allege, as it has been, hat his ideas were pirated can only be acceptable to those who have been indoctrinated into swallowing the party line on all matters. Even they must be puzzled why so little was known about his work until some forty years after his death.

When amateurs were amateurs!

In the early days after the war, when ex-WD gear was cheap and plentiful, many old-timers viewed with some disapproval the tendency for transmitting amateurs (and to a lesser extent broadcast receiver constructors) to use Services type gear rather than build up their own. Many openly voiced the view that it wasn't cricket – or rather, wasn't radio – or in modern parlance, that it was non-U. Before the war transmitting licences were granted only for experimental work. The actual communications side was merely incidental, and was intended to be used for the purpose of testing and proving. Hence the opening gambit 'Calling Test' used by British amateurs, instead of 'Calling CQ' as in post-war years.

Although at first it was considered slightly *infra dig* it was regarded as excusable in view of the difficulty in getting suitable new components. With the success, and extraordinary cheapness of ex-WD surplus, plus a large number of new entrants to the hobby, the use of services and commercial gear became more and more widespread. Even until fairly recently many of the old-time amateurs yearned for the days of low power, although they recognised that design was a more exact science rather than the trial-and-error methods of yesteryear. However, that would have been amply covered by the widened range of cheap technical books. Indeed, a very good case can be made out for a modernised form of pre-war licensing conditions.

For several years now, what remained of the old tradition has completely gone by the board. Today's fashions are not limited to converted ex-WD equipment, but the fully-built, ready for immediate use, maximum-powered amateur transmitting station is definitely 'in'. A half a dozen firms are specialising in providing amateurs with professionally built equipment, and an increasing number of amateurs are buying it, some of whom have never built anything worth mentioning of their own. Such a state of affairs would have been considered unthinkable in pre-war Britain, although the tendency had already started in the United States.

An examination of the lists of leading stations in any of the recent contests will reveal (where the equipment used is specified) that they all used professionally made gear. A strange contrast to the 'thirties when self-respecting amateurs even made their own microphones and a shack without a workbench would have been looked on as a sham! An unfortunate aspect of this use of commercially equipped 'amateur' stations is the unfair advantage gained by those with the deepest pocket. Indeed, since writing the preceding part of this paragraph, a correspondent in the RSGB 'Bulletin' questions the ethics of using expensive commercially-built equipment in contests.

Editor's Note: The *RSGB Bulletin* was the title of the Radio Society of Great Britain's monthly magazine, now known as *Radcom*.

DX–TV RECEPTION REPORTS

Compiled by Keith Hamer and Garry Smith

Sporadic-E activity returned with a vengeance during October. Indeed on many days conditions were as good as anything experienced during the summer months. Practically every European country was seen in Band I. The return of such active conditions meant that many of us were able to see the new Rumanian colour test card without having to wait until next summer.

A tropospheric lift occurred between the 22nd and 27th of October giving excellent colour signals from the Benelux countries and West Germany. The best trop signals were received in the north of England with tropospheric ducting from Spain and Central Europe while DX-TV enthusiasts further south found conditions fairly normal with only old favourites being received.

Reception reports

Andrew Webster (Billinge, near Wigan) was surprised to find an OIRT signal co-channel to his semi-local channel H signal from RTE (Dublin). This was on the 22nd and we suspect the transmission emanated from the Plezn channel R10 outlet (100kW) in western Czechoslovakia. On the 25th and 26th he was startled to find the TVE test card on channel E11 propagated by tropospheric ducting. This displayed the 'SANTIAGO 4' studio/transmitter identification. At first Andrew thought it was a strong E4 signal playing havoc with his amplifiers. The highest powered E11 outlet listed for Spain is at Caceres (45kW) in the south-west of the country which is some distance from Santiago in the north. On the 23rd while checking the ATV band Andrew noted the callsign of a French operator (F3YX) located in Paris. His full log for October is featured this month and it reflects the excellent tropospheric conditions as well as the unexpected upsurge in SpE activity:-

3/10/83: TVE (Spain) on channel E2; RAI(Italy) IA,IB,JRT (Yugoslavia) E3 using the 'JRT TV BGRD' PM5544 test card; ORF (Austria) E4 from Patscherkofel on test pattern; SRG-1 (Switzerland) E2 from Bantiger radiating the 'PTT SRG 1' FuBK test card. All reception via Sporadic-E (SpE).

4/10/83: JRT E3 on PM5544 test pattern, also programmes on E3 and E4; ORF E2a and the rather rare channel E3 outlet with the 'ORF FS 1' PM5544; SR-1 (Sweden) E3 on 'TV 1 SVERIGE' PM5544; CST (Czechoslovakia) R1 with the 'RS-KH' EZO-type test pattern, also CST R2 radiating the 'SR 1 TV BRATISLAVA' PM5544; TVR (Rumania) R2 showing the monochrome EBU Bar; RAI IA, IB, on progs; MTV (Hungary) R1, R2 on 'MTV-1 BUDAPEST' PM5544; unidentified progs on R1 and R2, possibly of Russian origin. All signals via SpE.

5/10/83: RTP (Portugal) E3 from Lousa on programmes via SpE.

18/10/83: RAI IA on progs; JRT E3, E4 on progs via SpE

22/10/83: ZDF (West Germany, 2nd Network) on FuBK test card and progs on channels E21, 29, 34, 35 and 37:DDR:F (East Germany) on E6 from Brocken and E12 (Sonneberg): HR (West Germany-Hessischer Rundfunk) E37 on FuBK test card followed by 'RHON KANAL 37' identification slide; HR on channel E8 (Grosser Feldberg transmitter) on 'HR 1 F' FuBK, SWF (West Germany-Suiwestfunk) E25 from Haardtkopf showing the 'SWF-HRF' FuBK; WDR (Westdeutsches Fernsehen from studios in Cologne) on E9 (Langenberg outlet), E24 (Aachen) and E30 (Nordhelle); NOS(Netherlands) E5 from Roermond: RTBF 1 (Belgium) with progs on E3 (Liege), E8 (Wavre) and E11 (Anlier): RTE 1 (Eire) channel H with a co-channel Eastern-bloc country on R10 (similar vision frequencies). This had the OIRT 6.5MHz sound-spacing.

23/10/83: RTBF 2 on PM5544 wi 'ANDERLUES CANAL 61' transmitt identification at the top between 01 and 0215GMT. Later in the day(!) WD E11 (Teutoburger Wald) and E30 (No dhelle) were noted using the 'WDR FuBK. Also received via enhanced tr conditions were: WDR3 on E40, E radiating the 'WDR3' FuBK; ZDF on E3 E37; RTBF E57 (Tournai on PM554 RTBF 1 on E8, E11 with progs; BF (Belgium) E10 on PM5544; NOS-1 c PM5544 followed by progs on E4 fro Lopik, also on channel E6 (Smilde), E (Goes) and E39 (Wieringermeer); NOS progs seen on E27 (Lopik), E31 (Roe mond), E32 (Goes) and E45 (Wieringe meer).

25/10/83: TVE (Spain) E11 on test car with 'SANTIAGO' identification followe by progs; NOS E4 with PM5544 and prog BRT E10 on progs; ZDF E34 with prog TDF (France) in Band III showing Antio teletext pages.

26/10/83: TVE E11 on test card; Belgia Dutch, French and West German tro signals present throughout the day.

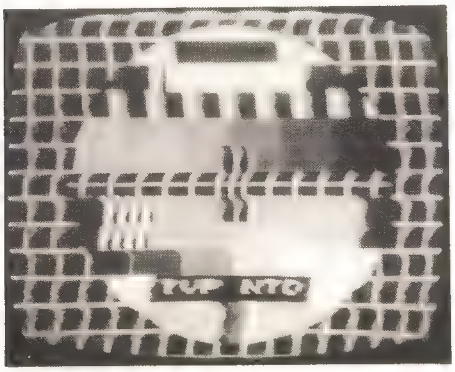
27/10/83: TVE E4 via SpE. Trop recep tion from France, Belgium, Netherlan and West Germany but on a reduce scale.

28/10/83: TSS (Russia) R1, R2 on colou electronic test card followed by prog rammes; 1SS R2 showing the 'Letterbo test pattern; CST R1, R2 on 'RS-KH' EZ test card; CST R2 radiating the 'SR 1 T BRATISLAVA' PM5544 pattern; RAI IA IB on progs; ORF E2a, E3 and E4 o PM5544. Many Italian private FM radi links were heard throughout Band during the opening. All reception vi SpE.

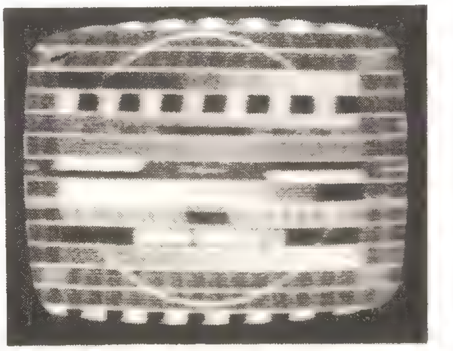
31/10/83: TVE E3 on programmes; (RT Portugal) E3 on a black and white bar tes pattern via SpE.

Full details of channel frequenc allocations were given in page 69 of th August 1983 edition of ***Radio & Electro nics World*** .

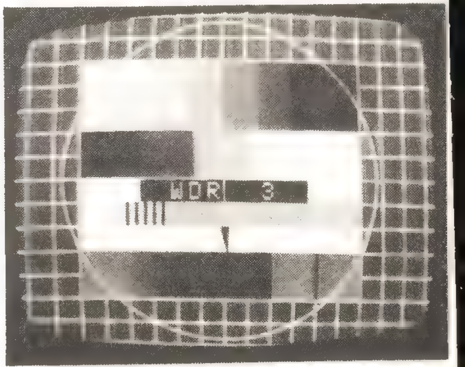
Over in Leeds, Kevin Jackson sa some of his best ever trop reception o the 22nd and 23rd. Using indoor aerials he received the East German test car snow-free on E31 much to the surprise o a visitor. The EZO test pattern from Czechoslovakia appeared on channels R10 and R31 between 1155 and 1224GMT from the Plezn transmitter. This tends t confirm Andrew Webster's reception noted later in the day. The 23rd was full o 'exotics' for Kevin. He switched on a



Polish PM5544 test card with identification TVP NTD



The new Rumanian colour electronic test card with the inscription TELEVIZIUNEA ROMANA



FuBK test card transmitted by WDR3 (West Germany)

05GMT to find RTBF Tournai on annels E57 and E63, totally snow-free. 0627 a programme on E40 was seen at ir strength but on the 525-line system om an AFN-TV outlet. A little later an FN caption appeared on E34 followed cartoons. The 500W relay in Brussels as noted at 0635 on the PM5544 test card th 'TELE 2' identification. Not content th those stations he discovered the olish test card on channel R35 (Jelenia ora) and R28 (Kielce) – a distance of me 1560km! Many other stations were ceived later in the day including the W relay of NOS on E51 at Eys. A total of Belgian, 19 French, 8 Dutch, 1 East erman, 2 Polish and 21 West German ansmitters were logged plus one in uxembourg. On the 26th an FuBK attern on E52 displayed the identificaon 'HESSEN DREI'. This was the 3rd etwork of the West German service essischer Rundfunk and was preceded y the FuBK test card showing 'HR3 FTM' identification and a digital clock. his particular test card was featured in e May 1983 edition of ***Radio & lectronics World.***

We have reports of a suspected ighting of Greece on channel E3. Cyril illis (Little Downham, Cambs) noted heir 'EPT' caption floating with other rogrammes around lunchtime on the 8th. We do not know of a transmitter fficially operating on this channel but in he past there have been sightings of the reek test card by DX-ers in the etherlands. The only Band I transmitter isted at present is on E4 with a low ERP. uring the same SpE opening Cyril saw many other countries including Austria rom their 100W channel E3 relay. He also oted Rumania on R2 radiating the monochrome EBU Bar test pattern.

October was also a good trop month for Simon Hamer at his farm in Powys. On the 22nd he received BRT on E43, Messischer Rundfunk on E37 from Rhon and TDF (France) on channels E21, 24, 31, 34 and 40. The following day he noted signals from NOS (Netherlands) on numerous channels in Bands I, II, IV, and V. Belgium, France and West Germany were also logged. East Germany (DDR:F2) made an appearance on E34 during the 26th and was a 'new catch' for Simon. Another novelty for him was reception of an amateur TV enthusiast (ATV) on 430MHz. The call-sign on the test card was G4IMO, based in Essex. Incidentally, the DX-TV converter which we featured in the August '83 edition of *R&EW* should cover the amateur band for those interested in ATV reception.

It's good to know that *R&EW* is read way up in the Arctic Circle. That's where Chris Hall is presently stationed. His Norwegian location at Krokelvdalen isn't recommended for DX-TV reception however since strong magnetic storms are frequently experienced in the 'auroral oval'.

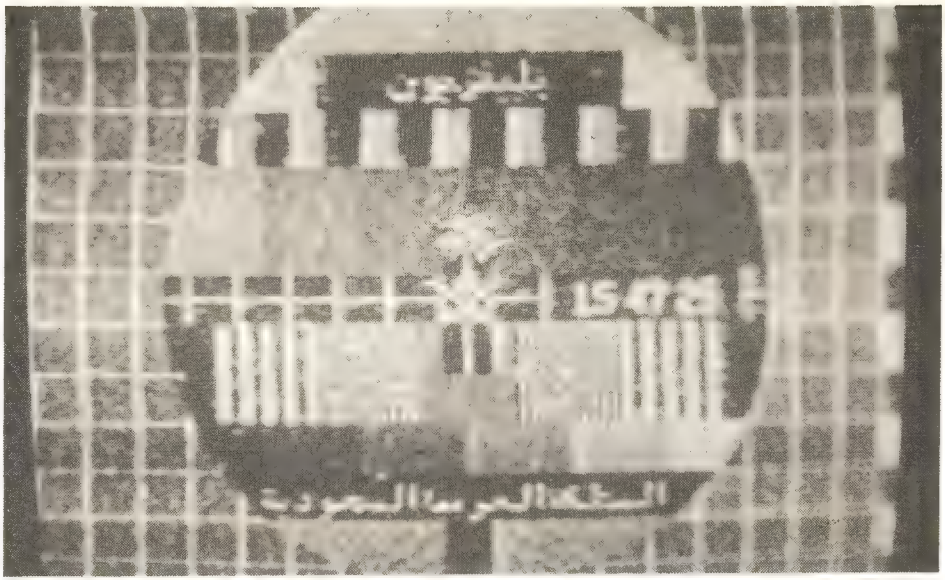


Photo 4 *Satellite TV reception by Hugh Cooks (East Sussex) of the Saudi Arabian PM5544 complete with palm tree and crossed swords in the centre*

African reception

Television signals from Africa have been received by Clive Athowe in Blofield, Norfolk. On the 7th Zimbabwe Television was seen using the PM5534 test card going onto a chequer-board pattern. Programmes were resolved at 1811BST. They were also noted on the 11th and the 14th from the same channel E2 transmitter at Gwelo. The reception on the 14th was accompanied by Italian transmissions on channel LA. Very often ZTV-Zimbabwe is propagated to the Mediterranean area by trans-Equatorial skip and then by Sporadic-E to the UK. SpE reception was noted on many days by Clive and signals included MTV (Hungary) on R1 and R2, TVE (Spain) E3, NRK (Norway) E2, E3 and E4, YLE on E3 from Finland, TVR-Rumania on R2 and TSS (Russia) on channels R1 and R2. During an opening on the 4th there were many OIRT FM radio stations present at the top end of Band I. Clive identified Bulgarian radio on 67.88, 67.10 and 66.32 MHz.

Rumanian TV

We briefly mentioned last month that Televiziunca Romana have introduced a new electronic test card. Thanks to the SpE activity we are able to feature the test card this month *(see Photo 2)*. This coincides with the introduction of colour transmissions by TVR. Surprisingly they have opted for the PAL system rather than the usual SECAM which the Eastern-bloc countries favour. The new colour test card has been received several times recently in the UK. It is similar to the East German one and two versions are in use: one with identification, the other without. One enthusiast in the north-west has seen this in PAL colour on channel R2. At first this was a head-scratcher since no identification was present. The old style opening captions are still used but propagation was not good enough here in Derby for colour reception. The ubiquitous Philips PM5544 is rumoured to be in use as well with the identification 'TVR BUCURESTI' at the bottom.

New DX magazine

A new magazine specifically for radio and TV DX-ers has been established by the authors of this column to help enthusiasts get the most from their hobby. The subscription rate for six bi-monthly editions is £4.50 (£7.00 for Air Mail delivery world-wide) and the magazine, called 'TeleRadio News', is available from 17 Collingham Gardens, Derby DE3 4FS.

Service information

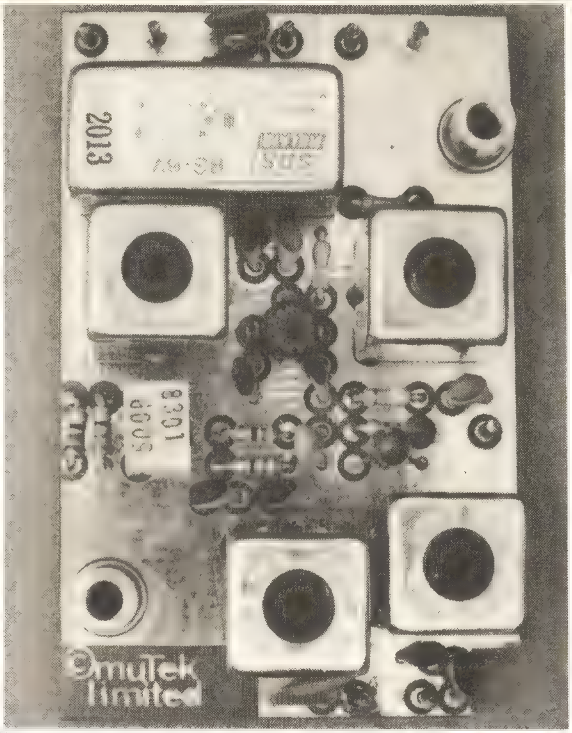
Belgium: For those DX-TV enthusiasts who may be wondering why they were unable to receive BRT on UHF channel E25 (TV2) and RTBF on E28 (Tele 2) during October the answer is quite simple. Severe storms caused the collapse of the UHF transmitting mast at Wavre. Apart from the loss of TV programmes, FM networks were also affected. The Wavre Band III channels E8 and E10 were not affected as a separate mast is used for VHF.

France: Amended channel allocations have been announced by Telediffusion de France (TDF) for the new service 'Canal Plus'. Programmes are now scheduled to commence before the end of 1984 using the following Band I (VHF) channels:- Channel 1 : 55.75 – 49.25MHz; Channel 2 : 60.50 – 54.00MHz; Channel 3 : 63.75 – 57.25MHz. Band III channel frequencies are to remain unchanged but will be numbered 4 to 9 rather than 1 to 6. Full details of TDF frequency allocations were given on page 69 of last August's *R&EW*.

India: The Indian TV service (All India Radio-Doordarshan) is now broadcasting in PAL colour but the old monoscopic Telefunken and Retma test cards are still radiated during test transmissions.

Egypt: There are two 900-watt transmitters in operation by the EBT at Dumyat. The 1st network radiates on channel E4 and the 2nd network on E2. Bearing in mind that signals from very low-power transmitters can be received via SpE propagation it may be possible to see Egyptian TV during the forthcoming DX season.

Service Information this month was kindly supplied by Gosta van der Linden (Netherlands), Alexander Wiese (West Germany) and the European Broadcasting Union (Belgium).



Bigger Ears Than Dumbo!

— the SLNA 145sb preamplifier for the FT290.

£27.40 + 1.20 p&p inc. vat

There are usually two reasons for the less than adequate sensitivity of current 144MHz transceivers. Firstly, the receiver designer's brief includes a dynamic range specification which leads him to balance large signal handling with sensitivity. With devices currently available at prices the transceiver manufacturer is prepared to pay, the balance comes-out to around 4dB noise figure and 70dB intermodulation-free dynamic range in ssb bandwidths.

The second point is that, also to save money, designers shy away from the use of electromechanical relays for antenna change-over switching and tend to use various forms of diode switch. These inevitably introduce greater insertion losses than suitable relays, approaching 4dB in some circumstances. Thus it's not unusual for the overall noise figure of a transceiver to reach 8dB.

At 144MHz sky-noise limits the maximum usable sensitivity of a receiver used for terrestrial communications to about 2dB noise-figure. (This about the same as 0.05μV for 10dB s+n/n in ssb bandwidths). Lower noise figures are easily obtainable with modern devices, but they won't let you hear any more! However there is a distinct advantage in using a very low-noise preamp to improve the sensitivity of a transceiver — if it has been designed properly.

Overall (or system) noise-figure depends not only upon the noise figure of the preamplifier, but also on its gain and the noise figure of the subsequent stage (the transceiver, in this case). By adjusting the gain of the preamplifier it is possible to set the system noise-figure to any wanted value greater than that of the intrinsic noise figure of the preamplifier.

Why bother to adjust the gain? Because any preamplifier will degrade the strong-signal performance of the receiving system. The name of the game is to use as little gain as possible ahead of the receiver; just enough low-noise gain to set the overall sensitivity to a level where external noise is the limiting factor is all that is required. Use any more and the dynamic performance of the receiver will suffer unduly. A very low noise preamplifier will minimise the gain needed ahead of the transceiver and hence the degradation of the dynamics.

The SLNA 145sb is a preamplifier which has been designed using the principles summarised above specifically for incorporation in the FT290. It will also complement other 144MHz transceivers for which no complete front-end modification is available. Ask us about FDK 700's and 750's for example.

A low-loss nitrogen-filled relay provides a same alternative to diode switching. This is followed by a BF981 in an input noise-matched, output conjugately matched configuration for a very low noise-figure and optimum dynamic performance. Following the output matching a variable attenuator provides gain control without compromising the dynamic performance, which would be the case if the normal amateur practice of providing gain control by varying the bias on G_2 of the BF 981 was followed.

After the attenuator, a properly designed Butterworth bandpass filter provides substantial rejection of out-of-band signals.

The preamplifier is constructed and tested to very high standards. A plated-through-hole epoxy fibreglass pcb is employed and bushed mountings are provided for mounting in the FT 290R. A cable kit utilising high quality ptfe dielectric cables is also provided.

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Access VISA

DATES FOR YOUR DIARY

Dates for your diary is updated every month.
lub secretaries and organisers are requested to send information of forthcoming events as early as possible to *Radio & Electronics World,* Dates for your Diary, Sovereign House, Brentwood, Essex CM14 4SE

th January	RSGB Presidential Installation	Cardiff Castle	RSGB Potters Bar 59015
th January	DX Operating by G3OLU	Braintree DARC	Pat Penny 0376 26487
	Annual Constructors Contest	Stourbridge DARS	Robert Taylor 021-357 5171
	Ring club for details	Rhyl DARC	John M'Cann 0745 583467
th January	Informal	Fylde ARS	F. Whitehead 0253 737680
	Grand Auction	Stevenage DARS	Cliff Barber 0438 89376
th January	Moulded Case Circuit Breakers	Leeds	IEEIE 01-836 3357
	Talk on Crime Prevention	East Kent RS	—
3rd January	Construction (bench facilities available)	Stratford upon Avon DARC	Ian Hopwood 0789 68863
4th January	Annual General Meeting	Biggin Hill	Ian Mitchell G4NSD 0959 75785
	What have you made?	Mid-Warwickshire ARS	Carol Finnis 092681 4765
5th January	Liquid Crystals – Beautiful and Useful	Hull College of Further Education	IEEIE 01-836 3357
	Activity Night/Night on the Air	Lincoln Short Wave Club	Pam Rose G4STO
6th January	Annual General Meeting	Greater Peterborough ARS	—
	Operational Use of Europeans Communications Satellite by the European Broadcasting Union	IEE, Savoy Place London	IEEIE 01-836 3357
rd February	A junk auction	Axe Vale ARC	Bob Newland G3VW Roger Jones G3YMK Upottery 468
th February	Bury Radio Society Ham Feast	The Mosses Centre, Cecil St, Bury	MHS Bridge G3VC
th February	Lecture and slides on Astro photography	Lincoln Short Wave Club	Pam Rose G4STO
21st February	Demonstration of 10GHz operation	Biggin Hill	Ian Mitchell G4NSD
22nd February	Activity Night/Night on the air	Lincoln Short Wave Club	Pam Rose G4STO
2nd March	A talk by Rex Williams G3RSJ	Axe Vale ARC	Bob Newland G3VW Roger Jones G3YMK Upottery 468
14th March	Lecture – Amateur Radio on a Shoestring	Lincoln Short Wave Club	Pam Rose G4STO
16th March	BCS/Computing Award Winner	Lancaster Polytechnic	BCS, Coventry Branch
18th March	4th Annual Components Fair	Carleton Community Centre, Pontefract	A. Mason G4TGU N. Whittingham G4ISC
28th March	Annual General Meeting	Lincoln Short Wave Club	Pam Rose G4STO
1st April	White Rose ARS Rally	University of Leeds	A.N. Bramley G4NDU
11th April	Lecture – UHF then and now with a look at RSGB Metre-Wave Awards System	Lincoln Short Wave Club	Pam Rose G4STO
15th April	Two-metre FM contest	Stevenage & District ARS	Bernard Dean G6NZC
25th April	Activity Night/Night on the air	Lincoln Short Wave Club	Pam Rose G4STO
28–29th April	RSGB National Amateur Radio Exhibition	National Exhibition Centre, Birmingham	RSGB, Potters Bar 59015

NOTICE TO ADVERTISERS!

Please make copy as legible as possible, preferably typewritten, in order to minimise printing errors.

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The communications, electronics & computers magazine

PARTS 1 & 2 OF THE AMATEURS HANDBOOK

If you missed the December and January issues of ***Radio & Electronics World*** with parts 1 & 2 of the Amateurs Handbook and would like copies, simply send £1.00 for each issue to:

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SHORT WAVE NEWS FOR DX LISTENERS

by Frank A Baldwin

All times in GMT, **bold** figures indicate the frequency in kHz

In the previous issue I brought to the attention of readers some of the Indonesian stations that could be received here in the UK now that the season for reception of transmitters in this area of the world is in full swing. Mostly, these were the more powerful transmitters which, of course, provide the best chance of getting through to our own islands here in the Northern Hemisphere. In this instalment of the South-East Asian saga some Indonesian stations operating on the more difficult 90 metre band (**3200–3400** kHz) are brought to notice.

Commencing at the low frequency end of the band the first 10kW transmitter is that of RRI (Radio Republik Indonesia) Bukittinggi in Propinsi Sumatera Barat (Province Sumatra West) from which location it is on the air from 0930 to 1600 (Saturday until 1700). It is in parallel on **4910** but the frequency that interests us here is **3232.**

RRI is a network owned by the Indonesian government and the stations in this organisation are those most often logged and reported by Dxers on the short wave bands. The main station is sited at Jakarta, the capital of the Republic, this transmitter radiating national programmes and feeding programme material to various regional networks. Most Indonesian stations are required to relay the news bulletins from Jakarta.

On **3250** you may be fortunate enough to hear RRI Banjarmasin in Propinsi Kalimantan Selatan (Province Borneo South). With a 10kW signal, it is on the air from 2200 to 0100 and from 0900 to 1520. On Sunday, the former time-slot is amended to 2300–0715. This one is often reported in the SWL press. GMT + 8 hours.

RRI Gorontalo is on **3265** from Celebes, the schedule being from 2100 to 2400 and from 0830 to a variable sign-off time around 1520. GMT + 8 hours.

As mentioned in the previous issue, the best time to listen for these Indonesian stations is at their opening times, usually from around 2100 to 2200 and just prior to the closing times, roughly from around 1500 onwards.

The **3265** channel is also occupied by another Indonesian in the shape of RRI Bengkulu. This one opens at 2300 and finally closes at 1600, the power being 10kW. GMT + 7 hours.

RRI Dili, Timor, operates on **3305** opening at 2155 and finally closing at 1415. GMT + 8 hours. The power is 10kW but the final closing time is not favourable as far as UK listeners are concerned. However, one never knows – logging Indonesian stations is something of a game of chance, one must be on the right channel under the right conditions at the right time – and that brings in Lady Luck! Select your channels and 'visit' them as often as possible – perseverance is the real key.

On **3325** there is RRI Palangkaraya, Borneo, opening at 2200 and finally signing-off at 1520. The power is 10kW and this one is also often reported by Dxers. GMT + 8 hours.

Then there is RRI Ternate on **3345** at 10kW, opening at 2020 and closing at 1415 but may also be heard – if you are lucky – in parallel on **3946.** This one is more often reported than RRI Pontianak on the same channel with a 5kW signal, opening at 2200 and finally closing at 1520 but also working in parallel on **3995** but with a 10kW transmitter. Ternate (Moluccas) GMT + 9 hours; Pontianak (Borneo) GMT + 8 hours

A tune to **3385** might bring success with RRI Kupang, Timor from where it opens at 2130 and finally closes down at 1520. The power is 10kW and is sometimes listed in Dxers loggings. GMT + 8 hours.

The last 10kW Indonesian transmitter on the band under review is that of RRI Tanjungkarang, Sumatra on **3395** at which point on the dial it opens at 2200 and finally closes at 1600. GMT + 7 hours.

Apart from the government owned RRI stations, there are five regional Nusantaras (Networks) each with a main station, thus Nusantara I (satu) covering Sumatra has a main transmitter at RRI Medan. Likewise, Nusantara II (dua) covers Java and Bali from RRI Yogyakarta; Nusantara III (tiga) from RRI Banjarmasin covers Borneo; Nusantara IV (empat) covers Celebes and Timor from RRI Ujung Padang whilst Nusantara V (lima) covers West Irian and the Moluccas from the main station at RRI Jayapura.

There are many other Indonesian stations that may be heard – albeit with some luck and quite a lot of effort – on both the 60 and 90 metre bands but in the main these are of the low-powered variety, from 1 to 5kW and therefore theoretically more difficult to log here in the UK. I shall be mentioning some of these in the next issue.

AROUND THE DIAL

Within which you will find the times, the frequencies and the programme contents of stations in the short wave spectrum that may, we hope, interest many of our readers. A start is made with –

AFRICA

Tunisia – Sfax on **15225** at 0557, songs and music in the Arabic style in a programme of the National Network and also for the Middle East, scheduled on this channel from 0430 to 2230.

Morocco – Tangier on **15335** at 1840, OM with songs, Arabic music in the Domestic Service Network 'A', timed on this frequency from 0700 to 2400.

Tangier on **15595** at 1503, Y with announcements in Arabic then dance music in the European style, all in the Domestic Service which ma be heard at this point on the dial from 1000 to 2100.

Tangier on **17595** at 1507, OM with announcements in Arabic on the Domestic Service which is scheduled here from 1000 to 2100.

Madagascar – Radio Nederlands Relay on **15220** a 2107, OM with an English programme, all about the use of home computers by Dxers as an aid to their hobby. This was in the English programme intended for Central and West Africa and scheduled from 2030 to 2120.

Nigeria – Lagos on **15120** at 2055, local-style music then YL with station identification and announcements in English, the 'Talking Drum' interval signal at the commencement of the English transmission to Europe and North Africa which is timed from 2100 to 2200. The programme commenced with another station identification, frequencies, target areas and a programme review.

Kenya – Nairobi on **4950** at 1855, OM with a talk in vernacular, OM with announcements, OM's with choral anthem prior to sign-off at 1900.

Benin – ORTB (Office de Radiodiffusion et de Television du Benin) Parakou on **5025** at 0455, interval signal which sounded similar to an off-tune violin, the theme being repeated many times then YL with an African chant-like song.

Guinea – Conakry on a measured **15308** at 2032, OM with a song in vernacular complete with musical backing in the local style and rhythm. The schedule is from 1600 to 0730 and the power is 80kW.

ERICA – SOUTH

uador – HCJB Quito on **295** at 2030, OM with station entification, frequencies d target areas, all in English or to the French ogramme commencing. CJB Quito on **17890** at 2130, M and YL with nouncements in Spanish ring the transmission in at language to the Americas d timed from 1530 to 2145.

azil – Radio Nacional, asilia on **15290** at 0122, OM th a talk in the Spanish ogramme to North and entral America, scheduled om 0100 to 0145. It was all out Brazilian politics.

Radio A Voz de Oeste, uiaba on **4775** at 0426. The ower is 1.5kW and the chedule is around-the-ock.

Radio Bare, Manaus on **4895** 0247. Just audible under a SSR transmitter on the ame channel. Radio Bare is the air from 0900 to 0430 at kW.

Radio Cultura do Para, elem on **5045** at 0300, OM ith station identification in ortuguese, an electronic ound effect and then off at 302.

Peru – Radio Rioja on **5045** at 303 immediately after RC do Para (above) had signed off. M with a song in Spanish ollowed by OM with promos. his one is on the air from 100 to 0445, power not known.

CLANDESTINE

'Voice of the Free Sons of the Yemeni South' on **11180** at 1420, YL with a song in Arabic until 1425 when OM with exhortations also in Arabic. In Arabic this one identifies as 'Sawt Abna' Janub al-Yaman al-Ahrar' and is hostile to the government of the PDR Yemen located in Aden. It is on the air from 1300 to 1500.

EUROPE

Spain – Madrid on **15125** at 2030, YL with station identification in Spanish, OM with announcements then into a programme of Spanish music in Programa Mundial (Worldwide Programme) which may be heard on this channel from 1900 to 2230 Monday to Friday inclusive.

Madrid on **15395** at 1958, OM and YL with the 'Topical Affairs' programme during the Spanish transmission which is on this channel from 1057 to 2200 Monday to Saturday inclusive.

Bulgaria – Sofia on **15110** at 0748, OM and YL with the English programme for Europe, scheduled on this frequency from 0730 to 0800. All about space exploration.

Romania – Bucharest on **15340** at 0529, interval signal, OM with station identification then YL with a newscast in the English programme for Africa, timed from 0530 to 0600. Another English transmission to Africa from Radio Bucharest may be logged on **15365** from 1730 to 1800.

NOW LOG THIS

Your attention is drawn this month to having a go for Wellington, New Zealand. Probably the best chance of reception for UK listeners is around the time it was recently logged here. Try on **15485** from 0430 onwards, actually heard by the writer at 0450, OM with announcements in English followed by a programme of brass band music.

The transmitter is somewhat elderly to say the least and is rated at 7.5kW. Programmes are mainly rebroadcasts of the Domestic Services and that logged was in the schedule for Australia and the North West Pacific Area, timed from 2015 to 1115.

The address is Radio New Zealand, PO Box 2092, Wellington. Dx reports must be accompanied by 3 International Reply Coupons and cassettes by 5 IRC's if return is required.

The interval signal consisting of the call of the NZ Bell Bird must be heard to be believed – it really does sound just like a bell.

FAR EAST

Burma – Rangoon on **4725** at 1544, YL with announcements in Burmese prior to sign-off without the National Anthem at 1546. The schedule is from 1030 to 1545 (Sunday until 1445) and the power is 50kW.

South Korea – Seoul on **15575** at 1415, YL with the station identification during the English transmission directed to North America and timed from 1400 to 1500.

MIDDLE & NEAR EAST

Pakistan – Azad Kashmir on **4980.5** at 1530, OM with a talk in Urdu, announcements, then into a religious programme. Sited at Muzzaffarabad this 10kW transmitter is scheduled from 1400 to 1800. Languages used are Urdu and Kashmiri.

Islamabad on **5060** at 1520, OM with a talk in Urdu in the Regional Service, on this channel from 0045 (December to March 0130) to 0230 (September to October 0210, 1400 to) 1600 (November to February 1630) to 1800. The power is 100kW but the frequency can vary at times from **5056** to **5062**.

Iran – Tehran on **15315** at 0534, OM with a talk in the Arabic programme for the Middle East and North Africa which is on this frequency from 0330 to 1300.

Iraq – Baghdad on **9610** at 2125, YL with the station identification, military music, various announcements followed by some Arabic music at the commencement of the English programme for Europe, scheduled from 2130 to 2230.

Baghdad on **15400** at 0525, YL with a song in the Arabic languaged Home Service Programme II, 'Voice of the Masses', on this channel from 0230 to 1800.

United Arab Emirates – Dubai on **15300** at 1840, OM with a song in the Arabic programme for Europe, North and East Africa, scheduled here from 1645 to 1700 (not Friday, Saturday or Sunday) and from 1700 to 2050. Also logged in parallel on **15320**.

Saudi Arabia – Holy Koran Radio, Mecca on **11730** at 0602, OM with quotations from the Holy Koran. This station is on the air from 0500 to 0700 daily.

India – Hyderabad on **4800** at 1539, YL with a newscast in English of local events. Hyderabad closes at 1740, has a power of 10kW and English newscasts at 1230 and 1530.

Calcutta on **4820** at 1540, same news as above, this one losing at 1740 and having an English newscast at 1530. The power is 10kW.

Delhi on **3925** at 1537, YL with the local news in English. With a power of 10kW this transmitter has English newscasts at 1530 and 1730.

SOUTH-EAST ASIA

Singapore – BBC Kranji on **3915** at 1536, YL with announcements in English during a programme of classical music. This station is on the air from 1300 to 1500 in Burmese, Indonesian, Bahasa Malaysian and Vietnamese and from 1500 to 1830 (May to October until 1745) in English. The power is 100kW.

SBC Singapore on **5050** at 1530, YL with announcements in English during a programme of popular light music on records. The schedule is from 2230 to 1610 (Sunday until 1700). The power is 50kW.

Malaysia – Kuala Lumpur on **15295** at 1548, YL with a song in the Arabic programme for South East Asia, scheduled from 1530 to 1700.

Radio Malaysia, Kuching, Sarawak on **4950** at 1524, OM and YL with a discussion in English. This one is scheduled from 2200 to 0100 and from 0830 to 1600 in both English and Chinese. The power is 10kW.

Guam – KTWR Agana on **11350** at 1320. OM with a talk in the Mandarin programme directed to China, scheduled from 0815 to 1500.

Indonesia – RRI Ujung Pandang on a measured **4719** at 1511, OM in Indonesian. The schedule is from 0830 to 1530 (Saturday until 1600) and the power is 50kW. RRI Banda Aceh on **3905** at 1537, OM's with a discussion, presumably, in Indonesian. Banda Aceh is scheduled from 1100 to 1600 and the power is 50kW.

RRI Palembang on a measured **4856** at 1519, OM with announcements in Indonesian, some local-style music then OM with more announcements. Palembang is scheduled from 2200 to 0115 (Sunday until 0700) and from 0900 to 1600. The power is 10kW.

NOW HEAR THESE

RRI Bukittinggi in Sumatra on a measured **4910.4** at 1522, OM with a talk in Indonesian. With a power of 1kW, Bukittinggi is on the air from 2300 to 0300, from 0500 to 0715 and from 0930 to 1600.

Or you may like to try for Melbourne, Australia on **6035** at 1555. OM with station identification and the news at 1600, all in the External Service to the Pacific Area, Papua/New Guinea and Asia, scheduled on this channel from 1530 to 2200.

EXT ISSUE · NEXT ISSUE · NEXT ISSUE · NEX

NEW IMPROVED

Radio & Electronics World

The communications, electronics & computers magazine

A 200W PEP TRANSMATCH

How to construct a unit that matches the solid-state transceiver with narrow-bandwidth low impedance antennae

PROGRAMMABLE SOUND GENERATOR

Roland Perry describes the use of AY-3-8910 sound generator chips

PEAK-INDICATING RF POWER—DEVICE

This easy to build unit uses LED's to indicate peak rf power and requires the minimum of components

OSCAR-10

Terry Weatherley provides detailed orbital information about the latest OSCAR – a must for satellite enthusiasts

AMTOR

An introduction to Amateur Telex Over Radio, followed by a description of a baud rate generator suitable for AMTOR timing

ONE NIGHTS WORK

Another of these popular projects from Stephen Ibbs. Next month he describes an audio amplifier using the LM380

DATA BRIEFS

The Hitachi HA 1197 is the subject of the March issue Data brief

PLUS all the usual features!
New Products • News • Reception Reports . . .

DONT MISS the March issue – on sale **10th February**

To be sure of your copy of *Radio & Electronics World*, complete the newsagent order form on page 86 or take out a subscription by using the form on page 73

EXT ISUE · NEXT ISSUE · NEXT ISSUE · NEXT

CORRECTIONS AND MODS

Whilst every effort is made to minimise errors in diagrams we will correct these as they come to our knowledge and we also appreciate the co-operation of our readers in notifying these.
We occasionally receive suggested modifications from readers who have constructed projects from ***Radio & Electronics World*** and we will publish those that would interest other readers.
For example, it may be possible to extend the use of a particular item by minor circuit changes or re-arrangement only. If this can be done for minimal cost and the idea has been proved in practice, others may benefit from the information.
Write to Corrections and Mods, ***Radio & Electronics World,*** Sovereign House, Brentwood, Essex, CM14 4SE.

Fax receiver Jan 84

o my eternal shame I have found an rror in the 2716 EPROM HEX listing age 35). BYTE 010F should be altered om 07 to 03. Fortunately the offending t can be programmed down manually.

A ready programmed 2716 is available r £5.50 inclusive from:- J & F Compuers, Rosehill, Ladock, Truro, Cornwall R2 4PQ

Poor man's Spectrum Analyser', Part (Nov 83 issue).

The following notes should be added o the relevant Figures. Please note that ome of the notes refer to American part umbers and it is suggested that the quivalent UK numbers would be availble from suppliers.

Figures 5 & 7: Resistors are ¼w, 5%. Jnspecified capacitors are 50V ceramic. hose marked 'SM' are ±5% silveredmica. Those marked 'FT' are 1000pF feedhru. Shielded boxes made from single nd double-sided G-10 circuit board plus copper shim stock.

Additionally (Figure 5) the emitter of he VCO transistor should be connected straight to earth, not via a resistor as shown and the MV209 or MV309 varactors may be substituted for MV10-9's (all Motorola products).

Also (Figure 7), L43-12rf transformers and FT37-43 toroids are Amidon supply. ***Figure 6:*** Filter box is 1⅛in deep, made from materials listed above. Coils are 6 turns of #12. Dimensions, ½in inside diameter, ⅝in long, taps at ¼ turn.

10pF piston trimmer is Sprague-Goodman GGP8R500 or equivalent, alternatively, air variable Johnson type 189-564-1.

Mount the BNC connectors near front side.

Coupling apertures are ⅜in x 3/16in. Drill ⅜in diameter holes in compartment wall pieces, then solder copper shim strips across tops and bottoms to narrow apertures.

'Facsimile reception' (Sep 83 issue).

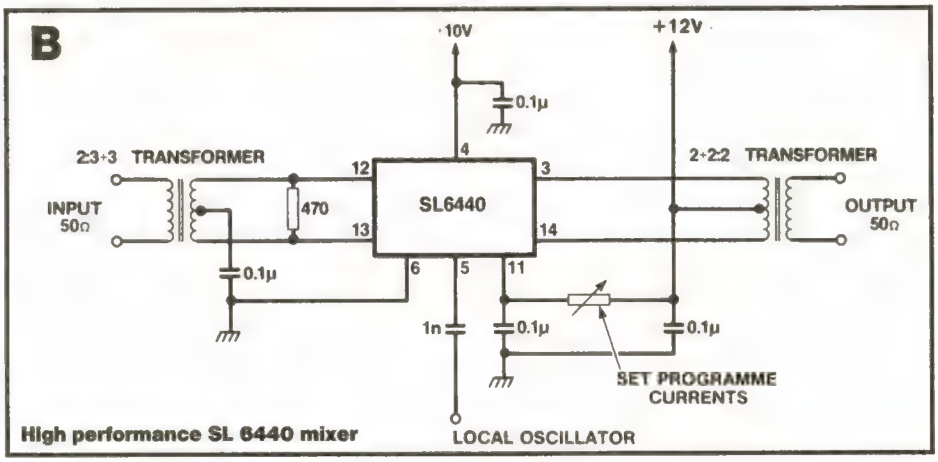
Keith Mitchell has drawn our attention to corrections to ***Figure 2*** (see diagram A).

LCD display option for the Rewbichron 11 (Jan 83 issue)

Stephen Ibbs advises the following correction. In ***Figure 2*** pins 2 and 4 of IC2 should be joined together; pin 6 of IC3 should be joined to pins 2,9 and 13.

Communications Building Blocks (Dec 83 issue, page 43, Figure 9).

We regret that the circuit diagram is not in accordance with the caption. The correct diagram for the Plessey SL6440-based mixer circuit is given in diagram B below.



High performance SL 6440 mixer

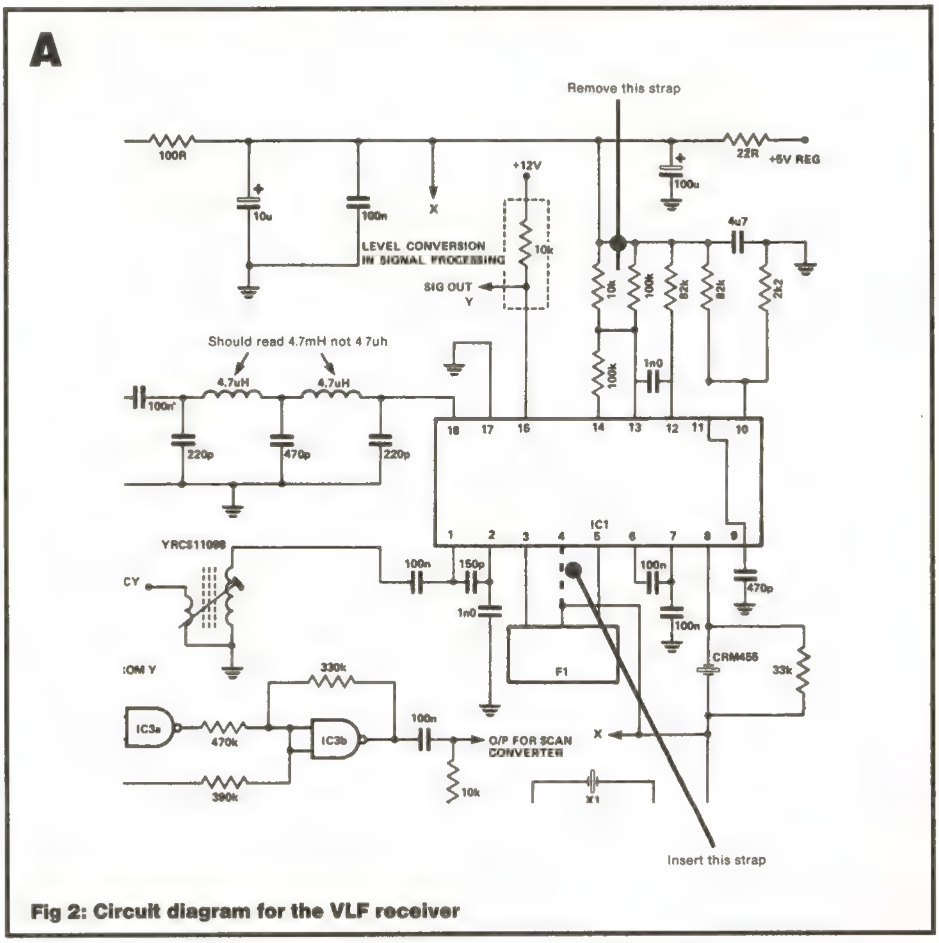


Fig 2: Circuit diagram for the VLF receiver

ATV on the Air

Presented by Andy Emmerson, G8PTH

More super SSTV pictures, sent on two metres by F1EDM to G8CGK and printed on a computer printer

Seventy centimetres

Seventy centimetres is our natural starting point and on 'that weekend' conditions were wide open. What's more, operating standards were high, reflecting great credit on all concerned, excepting the space-shuttle enthusiasts who occupied our calling channel on Sunday morning, giving us an object lesson on how not to work DX! Anyway, there were some excellent signals around – I have to single out Brian G8DTQ (Caterham), Ken G8DIR (Shrewsbury) and Jean-Francois F1EDM (Bordeaux-St.Clair) who all put out P5 pictures. All three used QRO amplifiers, which does help, but even 10 watt stations had a field day as well. F1EDM was so strong that he overloaded my masthead preamp here at Northampton and I had to unpower it to see his pix properly. He worked as far north as Shrewsbury at least, which is several hundred kilometres, and fair DX in anyone's book.

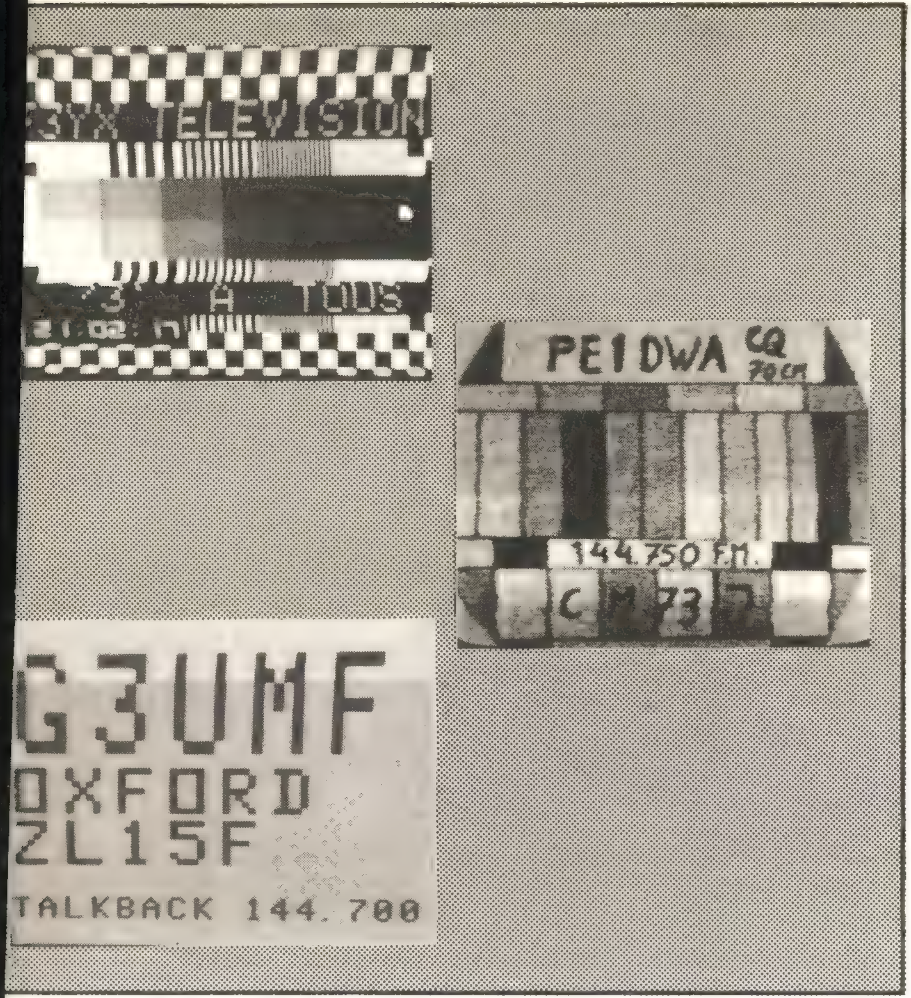
Other stations who were active recently include: G4MDU (Stoke Bruerne), G8CHK (Pattishall), G8JBQ (Milton Keynes), G3TGE (Newport Pagnell), G3UDC (Bletchley), G8FAK (Cranfield), G4CPE (Luton), G4HGZ (Dunstable), G4CRJ (High Wycombe), G8UGU (Long Buckby), G6LUV (Bletchley), G3UMF (Oxford), G8BWC (Nottingham), G8MNY (South London), G6TRX (Romford), GU8FBO (Guernsey), G6SKO (Somercotes), G6CUQ (Redditch), G8JMJ (Stoke), G3VPC (Wimborne), G4HMG (Iver), G6YLG (Sedgeley), G8VBC (Woodville), G1BTF (AL32e),
G4EUF (Leicester), GU6EFB (Guernse
G3YQC (Rugby) and yours truly G8P
(Northampton). Obviously there
many more, but these are the callsig
reported to me! DX stations logged in
Midlands included DD5CE, PE1G
PE1DWQ, F3YX, PE1HLA and PE1DW
Just because you don't live near
coast it doesn't mean you are debarr
from seeing/working continental s
tions! In fact, this year has been ve
good for UHF openings and as long
you keep an eye on the 'DX indicators'
patterning on out of area ITV channe
you shouldn't miss the lifts.

Incidentally, during the Decemb
opening I noticed a couple of statio
were having difficulty with solid sta
'linears'. Basically, they were tuning f
maximum power on the output mete
Unfortunately, this doesn't work with
and merely produces a cramped ar
unwatchable picture with no syncs. TV
negative modulation, so in fact yo
should tune for minimum on the pow
meter – this sounds crazy but it's (almos
true! You really can't transmit TV unles
you can see the outgoing waveform ar
this means having a detector in th
antenna feedline coupled to a 'scop
Apart from getting some tolerant perso
to 'talk you in' there is no other way
sending a properly modulated TV signa

News from North Wales: Dere
GW3FDZ (Dyffryn Ardudwy) and Keit
GW8WNB (Tal-y-Bont) are on 70 cm T
every Wednesday evening at 8pm (talk
back on 144.75). They'd welcome extr
folk in the net, so why not join in? Thei
locations enable them to cover most o
Cardigan Bay and they will be pleased t
arrange schedules (ring Dyffryn 343 o
7714).

Our Scottish scribe, Norrie GM4BVU
has been transmitting SECAM as well as
NTSC! Monday night is activity night in
central Scotland: stations to watch ou
for are Keith GM8HGT (Shettleston),
Angus GM4JYZ (Kirkintilloch), GM4UBJ
(Motherwell), George GM6AOR (Longridge), Iain GM6HFH (Stonehouse),
Tom GM4PRO (Chapelhall), Tom
GM3HBT (Larkhall) and Willie GM8FAA
(Moodiesburn). To finish 70 cm, the
following had their pictures in the

Closed circuit quality (colour) SSTV received by G3WW on 30 November 1983, from Italy.



election of 70cm pictures received from near and far during October 1983 by Andy G6LTZ at Old atford, Bucks. F3YX is near Paris and PE1DWA in Zoetermeer, Netherlands

nelux DXers magazine, having been ceived on 18th June in Holland: RJM, G6BIA, G3UMF, G3ZUP.

00MHz and up

The excellent opening mentioned ove was just as good on 24 cen- metres, and several stations exploited is fact. CQ-TV editor John G3YQC in ugby saw plenty of activity on the 3rd ecember and had a P5 two-way contact th G4CPE in Luton. John also transmit- d to F1EDM who was able to receive his gnals at P4.5 and then transmitted them ack on 70cm to prove the point.

Another who played this trick was Rod 8VBC (Woodville, Derbys.), who also ad a P5 two-way with G4CPE and anaged to get a P5 report from Jean- rancois (40W rf output). Rod also saw his wn pictures coming back. Unfortu- ately F1EDM's 24 cm transmitter was ut of commission but Rod achieved his rst two-way to France when F3LP (Le Havre) returned his signals. This contact vas P1 in both directions. F1EDM clearly as an excellent site and appears to aunch straight into the ducts.

Rod remarks that radar interference rom Clee Hill is awkward at all times, but during this lift it was intolerable, wiping out all reception with Rod's normal ather wideband FM system. He had to esort to slope detecting signals with an AM receiver (narrower band). This at east gave recognisable pictures but even then the screen was blanked out every seven seconds.

Other 24cm news has been received from Ian G8CQE (near Croydon) who has been starting QRP tests with Dave G8GKQ in Penge. Dave is slope detecting, using a *R&EW* design converter. Tony G8XRX in Lancing is one of the Worthing Repeater crowd and is on the air on 24cm. To transmit he uses the RadCom microwave drive source and a 'black brick', the blue ones having run out! This gives 4 watts ready for a varactor tripler; the diode for the latter cost just £1 and works just as well as the expensive ones (which are available again from Wood & Douglas). The receiver is a BATC converter and BATC FM IF strip. The antenna is a homemade 23 element yagi. Tony is building a 2C39 PA to the CQ-TV design and is just waiting for the DX...

Repeater news is good – GB3VR is operating for tests under manual control at G8KOE's residence and seems great. GB3GV has also been tested as a beacon, and as soon as the proper licences come through we can expect great things. 1984 will be the year of the repeater!

Slow-scan news

This time I have lots of SSTV news. I actually met an SSTVer at the Leicester rally and he assured me there are others like him, though he was reluctant to identify himself or put pen to paper, presumably for fear of incriminating himself. A bolder type is Grant G8CGK in Ross-on-Wye, who received good pix on two metres during the December opening from PA0APM, DF8BA and F1EDM. Signals from the latter were so good that they look like closed circuit quality, proved by the printout Grant sent in. He has his receiver linked to a computer system and an Epson MX-80 dot-matrix printer which does a superb job with the SSTV image. Grant also bemoans inconsiderate FM stations who say 'QSY 1 MHz down' from S20, land on the SSTV calling channel and then complain of 'thermostat' interference. It's a pity that some folk are not aware of band plans and speciality modes; perhaps they don't read this column.

Richard G3WW (Wimblington) sends a comprehensive list of active stations: noteworthy are Keith G4GZN (Catford) and G3CCH. Richard has now worked 1,937 SSTV stations two-way in more than 111 countries, a remarkable record and mentions two SSTV nets held every Saturday, IVCA at 1500 GMT on 14230 and the USA net at 1830, again on 14230. He mentions two new SSTV periodicals hailing from the States, 'SSTV Today' and 'Vision'.

Colour is the thing in SSTV these days, with a variety of standards and commercial solutions for achieving the colour signals. The G3WW and G4GZN method is 24 seconds single frame, with a Volker Wraase SC-1 converter and Kaga 12in RGB colour monitor. These monitors will work with a 'fix' of Richard's but he has not yet found a way of getting analogue input or contrast control for these monitors.

Amateur Radio Exchange have the new Wraase SC-1 scan converter mentioned above. The first person to get one was Albert G4NJI (Rotherham), who proudly collected his at the Doncaster rally and rapidly put it to good use. The SC-1 will also receive the American 16 and 32 second monochrome transmissions, also FAX. Another new gadget is the American 'Blinky' audio tuner, which takes the skill/guesswork out of lining up SSTV, RTTY and CW signals for computer terminals such as the Robot 800 multimode terminals. Some amateurs still use long persistence CRTs, of course, and you can work SSTV with very modest equipment.

Final notes

Robin G8XEU has enhanced his Spectrum program mentioned previously, and it is now available on Microdrive for £10.50 inclusive. A BBC version is on the way, too. Details in return for SAE to Robin Stephens, Toftwood, Mill Lane, High Salvington, Worthing, Sussex. Ask for details of other radio-orientated software. In Athens, BATC member Bill Mercer has at last got a working SECAM coder, using the Hitachi HD4007 i.c., which also produces all the pulses for a subcarrier locked PAL coder. Bill is also building the John Goode PAL coder.

That's it: there has been a lot this time, so apologies if I had to trim down your news. Let me have more for next time and send it to me care of the editor.

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- Double beam oscilloscope (telequipment type D31R) in good condition with manual, Working order, no marks on phosphor. Size 6½in x 13in x 13in. £50. Tel: Chester 671994 after 6pm.
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- ICOM IC-260E 2M all mode transceiver, three memories, tone burst, input for microprocessor control, ten or three watts switched, £240 ono. Write or phone, P.R. Smith, 17 Aled Drive, Rhos on Sea, Colwyn Bay, Clwyd, LL28 4UU. Tel 0492 40780. May be able to deliver by arrangement.
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- Trio 2200GX all X tals ni-cads charger case £60. Tel: Connolly, Bristol 851285.
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- Dragon Disasse M61Y programs for sale £3.00 each. Adrian Stokes, 104 Exhall Close, Church-Hill, Redditch, Worc's, B98-9HZ. Tel:(75) 60495.
- Hacker Radio RP38 £25 ono. Murphy B815A Radio £25. Both excellent condition. Tel: Nuneaton 388449 will swap for DF set. M. Alton 59 Purcell Ave., Nuneaton, Warwickshire. CU11 4SN. Tel: 388449
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● ATV Program for the 48K Spectrum as reviewed in Nov 83 R & EW now with 36 features including testcards, maps, large printing, QRA calculator and much, much more. The price which includes a 16K version and full instructions is only £5.50 inc.p.& p. from R. Stephens, Toftwood, Mill Lane, High Salvington, Worthing, Sussex. For list of other programs send sae.Tel: Worthing 67228.

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● Phillips N1700 + tapes 'working' but cassette holder stuck. Anybody with B16 hammer? £50 ono Mr CG Holloway, 42 Oban Street, London E14 OHZ tel:01-987-2296

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● PFI Pye pocket phones two pairs unmodified with batteries £8.00 a pair Elliott 0767 80043 (Sandy Bedfordshire)

● FRG.7. Yaesu receiver mint with FM £140. Also ham Int'l 'Jumbo' complete with service manual boxed mint. £250 ono. Please ring after 6pm.TG Hellyar, 'Harlyn Place', Harlyn Bay, Padstow, Cornwall PL28 83Q Tel:0841 520000

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● ZX81 morse keyboard sending program. 50chr buffer (type into buffer during sending) plus fixed messages/variable length gaps for contests. 2-180wpm, uses G4CIZ port Sept 82 'Radio Communication' includes M-S send facility that article

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with instructions for other output ports 2k or more memory required. £4-40 post free. A. Wallbank G4CIZ 22 Oakfield Road, Pamber Heath, Basingstoke, Hants RG26 6DN

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- 2 ele cubical quad io 15 m f/glass spreaders (one repaired) 6 extension spreaders for 20m. £55 ovno Yaesu MO1 scanning desk mike good condition £30 inc carriage. Prefer buyer collects quad or pays postage. Clive Field, 84 Ram Gorse, Harlow Essex CM20 1PZ Tel: (0279) 28857
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- ZX81 plus 16K memory with over £15 software yours for £35. H.H. Exley, 'Woodlands', Half Acre Drive, Rochdale, Gr. Manchester OL11 4BU. Tel: Rochdale 46585
- PCB boards with Z80 and eight 2708 memories, lots of other comps. £4-50. Strumech 60ft telescopic tower wall mounting £250. 5 H.P. motor £15 also 3 H.P. and 1.5 H.P. GEC C.T.V. tuner/IF/decoder/video O.P. boards £4.50. Colour TV faulty £10. 4CX250 and base, 1931 radio. Ultra-sonic alarm panels, call Tony 01-452-6724 leave message
- Phillips N1700 long play video 4x2h tapes as new condition but picture not 100% offers to 0621 828807
- Realistic h/held 27MHz C.B. transceiver with charger, batteries, antenna adaptor, also ZX81 complete and boxed with many mags. Both items £100 ono. May consider split sale tel: 01-791-1331 can deliver
- Trio TS530 AT230 SP230 mike headphones narrow filter. List price £800. Best offer secures. 22 foot telescopic galvanised mast. Best offer secures. Would consider solid state HF gear part exchange or multi mode VHF. Andy G401N 021 451 2571
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- Mizuho MX2 SSB/C.W. handheld with speaker–mic. £75 or part exchange for W.H.Y. John (G8BXO) QTHR. J.H. Stacey, 3 Westpark, South Molton, Devon EX36 4HJ. Tel: 07695-3382
- Facsimile (weather map) printer and electronic unit (see R&EW January issue), Muirhead, with data, £50. Marconi mobile data equipment items: miniature printer £35, soft copy unit (scrolling 32-char. alphanumeric L.E.D. display) £35. Futaba proportional radio control outfit, complete and almost new, £30. Much more: instrument cases, meters, rotator, aerials, 200–400 MHz FM manpack transceiver, keyboards, V.D.U. cases, etc. Write for list – Bob Sayers, 40 Royal Oak Drive, Leegomery, Telford, Shropshire TF1 4SS.
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● TX Valves: 2C39WA £20, 2C43 £40, VT4.C £25, 624 £10, 808 £10, also many other American and European receiving and special purpose valves. Write for the prices and shipping cost. Behzad Rajaie, 18 Shirin St, Ararat Street, Vanak Avenue, Teheran, Iran, 19948.

● AVO multi-range test meter £40, VHF 2M transceiver base station FM £35, AVO electronic test meter £60, Collins UHF Receiver 200-400MHz £150, Wide Band amplifier 0-50MHz £30, Transistor PSU variable output £15, buyer collects please apply:- Hayward, Sunnyfields Lighthouse Road, St Margarets Bay, Dover, Kent, CT15 6EJ.

● Sanyo receiver RP8880G 9 Bands Crystal marker double conversion seldom used very good condition £95. R Hubbard, 9 Regency Drive, West Byfleet, Surrey, KT14 6EN. Telephone Byfleet 40468.

● Super bargain large quantity of LCD radio watches covers all medium wave with one year guarantee also black and white TV's six months guarantee from £20, mains clock radio's MW, LW, FM, usual price £32.99 our price £15.99 with one year guarantee. Peter, 136 Hazelbury Road, Edmonton, N18.

● Trio TS130S transceiver with mobile mount and AC PSU £450, Pye Cambridge FM10D and Storno CQM39 both xtalled 70.26 70.48 £50 together, or will split. Please ring after 7pm for details. Tel: 01-866 6432.

● Hitachi B/W 14" TV TU75/UK as new condition 12V/240V operation UHF only, ideal ATV RTTY computer monitor £35 Diawa SR9 monitor receiver 2Mtrs S20, S19, R3, R4, R5, R6, R7 crystals fitted + VFO £35. Telephone: Gravesend 24666.

● Teletype ASR33 with stand, working, excellent with manuals £40. Honeywell high speed optical tape reader, working, manuals £20. Two IBM Golfball typewriters with I/O solenoids. Would make excellent letter quality printer, one working one repairable complete with IBM service manual. Pair for £50. Buyers collect. Will haggle 0869 242691 Oxford.

● Kenwood TR8400 mobile 70cm FM Rig IOW O/P with mounting brackets, boxed, very good condition £175. Jaybeam 8 over 8,144MHz slot Yagi unused £25. Tonna 21 element 70 cms Yagi £15. G4MUT, QTHR, Reading (0734) 693766.

● Realistic DX100 Comms receiver. Brand new boxed £65. KW2000a. HF Rig. KW serviced £175. Brand new boxed matched 6146 PA valves Pair £15. JVC stereo cassette radio recorder never used £65. Contact John Randall G30AZ 243, Paddock Road, Basingstoke, Hants.

● Datong D70 Morse Tutor £25, GW6 ETK 41 Bond Street, Swansea, SA1 3TU. Telephone: Swansea 470683.

● Power supplies switched mode made by Gould. Up to 15 volts at 14 amps £50. Up to 15 volts at 7 amps £25 G4FMD Chelmsford 460515.

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● ASR 33 Teletype Westrex with tape reader, punch and on pedestal £55 Marconi SSG Type TF 1066A 10-470 MHz fully serviceable £75. Eddystone receiver type S680/2A 450kHg £45 Phone Slough 45939.

● 1924 Practical Electricians pocket book by HT Crewe MImech E, offers. Two Cossor SU750 valve rectifiers boxed, offers. 'Advance' voltstabs CV 100A output 250V 100W bulb load, 244V 150W bulb, further tap 316V no load, leaflet, circuit £5 each. 3-807 valves £2.50. 2 6BH6 £1. .5MFD 2500V condenser £1. 244 Ballards Lane, London, N12 0EP Telephone: 01-445-4321.

● Advance instruments signal generator 10kHz – 100kHz sine, square, output attenuator £25. Factory built bench PSU 0-30V 2A metered short circuit protected £30 ono. A VO 8 MK5 mint condition hardly used complete with leads handbook £75 ovno. Radio and TV servicing manuals from 1968 1974 7 volumes £15.00. Mr B A Smith, 27 Dartmouth Road, Ruislip, Middlesex, HA4 0DD. Telephone: Ruislip 32341.

● Racal RAIYW receiver for sale very good condition with hand book. £165 ono. S O Hesweth, 91, Woodley Hill, Chesham, Bucks, HP5 1SP. Telephone: Chesham 785557.

● Mains transformer 350-0-350V 120MA 6.3V 5A CT. 5V 5A (12V series). £5. LF smoothing chokes. Early 'Varley' push pull output transformer double ratio, offers. Auto transformer. GE USA. 230V to 110V 500W, £5. 'Leak' TL/12 plus mains transformer with output transformer 4,8,16 ohms. Large 'Elstone' output transformer believe for Williamson amplifier. Two 4MFD 600V USA capacitors Hunts 2MFD 1.2kV working £1 each. Transformer. Suit Linear Amplifier 500-0-500V 425mA 2.5-0-2.5V 6A 3.15-0-3.15V 4.2A, 3.15-0-3.15V 300mA, £10. Edwards, Telephone: 01-445-4321.

● Music centre for sale: Pye 1612 music centre only £50 Good as new only twelve months old. Would accept £45 to £50. Telephone: Penketh 6900 anytime after six pm. Halina MW 35S compact camera Auto wind, auto-rewind, auto flash only £20. Telephone: Penketh 6900.

WANTED

● Any manuals for Govt surplus radio equipt especially RAF AP2276 series US Army TM11-487 RN BR-1771 series also spare parts and accessories for US AN/GRC and AN/VRC series equipt and accessories and units for AN/ARC-S aircraft TX/RX. I.G. Mant G8AVJ, 28 Welbourne Road, Childwall Liverpool L16 6AJ. Tel:051-722 1178

● Any WWII R.A.F. airborne equipment also foreign top price for a T.R.9. what have you. 52 Bramble Lane, Mansfield, Notts NG18 3NR.

● FT225RD in excellent condition with Mutek board and original packing – offers to Peter Crosland, Red Lion Cottage, Holt Heath, Worcester – 0905 620041 home or 021 454 8585 business.

● Wanted handbook and 2M conversion data for Burndept BE201 transceiver contact Brian Robinson, 68 Langholm Drive, Heath Hayes, Cannock, Staffs. Tel: (0543) 77581.

● Valve mixer Vortexion type 3/PPM also leak valve power amplifier type TL/50 plus good price paid for clean equipment. K.J. Forster, 10, Springfield Oval, Witney, Oxon OX8 5EG.

● Radio Amateur/electronic fan – wanted for exchange of experience and difficult/obtainable expensive electronic parts. My rig is IC 211 and Video-Genie 3003. Arne Bruun; Vestervaenget 45: DK-6900, Skjern, Denmark.

● SSB adaptor for Racal RA17K. Model RA63 or RA98 preferred but RA121 or RA218 acceptable. Good condition essential. All replies answered. State price and delivery details. Alan Thompson, 16, Ena Avenue, Neath, West Glam. SA11 3AD. Tel: 0639-4040

● AVO 8 CCT. DIA to repair OHMS range. For sale servicing UK CB radio cost £14.95 accept £10 inc P.P. Electric guitar £10 EF91 75p (new) ECC91 £1 both plus P.P. Also EB91's 25p each. Mike Walker, 96 Sunnybank, Hull, N.Humberside HU3 1LF. Tel: (0482) 447202

● Wanted please circuit manual or diagram for RCA AR88D willing to buy or photocopy please ring Bridgwater (0278) 423288 plant.

● Wharfedale 100.1 Multiplex. Receiver diagram and service data. E. Lark, 10 Colman Ave, Stoke Holy Cross, Norwich NR14 8NA. Tel:050-86-2573

● Collins 32S-1 75S-1 spares. Mechanical filter V.F.O. dial xtals 6955kc 8677.5kc 12177.5kc scrap set considered. T.L. Simpson G3NSF, 58 Cemetery Road, Houghton Regis, Dunstable, Beds. LU5 5DA. Tel: 0582 62621

● One clean copy Newnes Technical Book Radio Circuits explained by Gordon J. King. At reasonable price. John Baird, 9 Alburne Park, Glenrothes, Fife, Scotland, KY7 5RB. Tel: 0592/752992.

● Marihe and Air Band Battery or mains receivers also multi band Uniden CR 2021 or similar portable covering ham bands. Phone Bradford Yorks 676556 after 6pm.

● Will swap Olympus pen EF auto camera built in flash half frame value £45 new for frequency counter digital type. Tel:061 969 0785

● Your old radio amateur equipment and any receiver i.e. Marine amateur etc. wanted for cash.Apply in writing with details to Mr Hughes, 85 Portfield Haverfordwest.

● Manual for Tektronix 564 storage scope with type 351 dual trace sampling unit and type 3T77A sampling sweep. Mr G.J. Wimpenny, 30, Faircross Way, St. Albans, Herts ALI 4SD. Tel: St. Albans (0727) 52003

● Pre 1978 World Radio and TV handbooks. Price wanted and condition please to Geoff Mersereau, Crucible Theatre, Sheffield S1 1DA. Tel:0742-760621

● Wanted Ediswan B8F base for 4CX250, UHF type with screen bypass capacitor of approx 1000pF with or without chimney. Also needed SK606

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Eimac chimney for SK600 series base. Phone G4RUL Eastbourne 53618 evenings only please.

- Circuit diagrams for C.B. rigs AM FM SSB and legal UK CB rig. Diagrams required especially wanted Hy-gain 5 model 2795 diagram. Any information contact I Wiseman, 13 Swift Gardens, St Giles, Lincoln LN2 4NA.
- Circuit diagram or manual for Nagard type 5002A double pulse gener'r. Even list of valves used would help. D Anderson, The Croft, Albert PStreet, Nairn. Tel: Nairn (0667) 53256 any time
- AR88D fair price for good condition or cheap for repairable model. 888A 750 or others considered. D. Muldoon, 68 Wroxham Drive, Wollaton, Nottingham NG8 2QS. Tel: 284195
- AM1OD or AM1OB Cambridge or Vanguard for newly formed A.T.C. unit. Must be high band and working or W.H.Y. Tel: Halstead (0787) 476925 after 7.00 p.m. G4DPZ QTHR
- Wanted circuit/info on Taylor model 33A scope. Donald J. Munro, 3 Sinclair Terrace, Wick Caithness KW1 5AD. Tel: (0955) 2085
- Wanted 2M 144MHz Transceiver Trio Yaesu Aov Icom FDK would like any base mobile hand held like IC2E AR240 FT208R would like side band CB or would like 2 pye 70s hand held pmr-s or any mobile base hand held on any MHz. Alastair Hunter, 27 Crichton Rd, Pathhead, Scotland, Midlothian EN37 5RH. Tel: 0875 320 642
- Wanted circuit diagram Eddystone 840 receiver loan or purchase. Underwood, 15 London Road, Stroud, Glos GL5 2AR.
- New members for new club!! (not CB) come along any Tuesday to the 308 Arc. At the Coach House behind St. Marks Church, Church Hill Rd. Surbiton – or contact Sec. Dave (G6YQD) 01-399 5487
- Camera control unit Akai CCU 150 or video recorder Akai VT 150. Iain McHardy, Navity, Cromarty Ross-shire IV11 8XY. Tel: Cromarty 451
- Exchange Trio R1000 receiver 100kH, – 300MH for good solid state H.F. TX/RX 80-10 metres, Mike Thomson, 1 Osborne Terrace, Arbroath, Angus, Scotland. GM4JeJ QTHR
- Racal SSB adapter – may be able to collect from near London or Liverpool or North Wales – also want BBC micro software for RTTY and other communications – write or phone, Bob, 17 Aled Drive, Colwyn Bay, CLWYD/0492 40780
- Nombrex or similar battery signal generator also Heathkit Mohican, working or needing repair. Details first please. R. Wilson, 4 Brookside, Pathfinder Village, Exeter EX6 6DE
- Wanted pair Tannoy Windsor speakers, Smallfield (034-284) 3149
- PSU for Yaesu FT 200 or mains x former for same. G. Irvine G140H1, 22 Carnreagh Bend, Newtown Abbey, Co Antrim, N. Ireland. BT37 9EQ. Tel: 0231 60243.
- Collins 51S1 Gen. Cov. receiver. Details Tel: 0473 79186.
- Sommerkamp FL100B or FL200B. S. Tubb, 11 St Andrews Rd, Bexhill on Sea Sussex. TN40 2BQ.
- Tuner Unit AT7672/24 for Labgear signal strength meter type E5188. Phone Ferndown (0202) 877920 evenings or weekend.
- Electronics circuit note book. Mohammad Bomjanian, 649 Neshat, Post Box Esfahan, Iran. 649. Tel: 30209.
- Information handbook on Oscilloscope, Type C1-5, 3in, made in USSR, 1968. I will pay for photostats, etc. Please write, Nussey, 11 Newland Road, Droitwich, Worcs. WR9 7AF.
- Small scope required in good order. Physical size is important. Full details to: J.I. Boyle, 35 Cannon Street, Preston Lancs. Tel: Preston 50193. (2-5pm only).
- 2X Spectrum 48K computer. I. Kendall, 4 Howlets Terrace, Chelmondiston, Ipswich.
- Acorn Atom owners. I would like to buy or exchange programs, especially radio application, although any will be greatly appreciated. Also especially a morse tutor program. Other information about the Atom also wanted. Have you any information on the vintage No 19 set? For either please write to: Kevin Lewis, c/o 36 Victoria Road, Salisbury, Wilts. SP1 3NG.
- RTTY and CW for the ZX Spectrum: need good software. I have built both decoders and use Usart 8251A interface for the Micro. Will correspond and exchange diagrams too. Also interested in Spectrum, I/0 Ports and A/D convertors etc. Filip Rogister. 4 Kroendaalplein, B-Igoo, Overijse, Belgium.
- A14, A14 spares, A13 A43 A42 C12 C11 C13 C42 and B48 transceivers. GRC9, PRC316, PRC361. W/S31 12/24V PSU R216 receiver. B70 VHF transceiver B44 MII/III Tripod, phones, aerial. Contamination meter No.1. Information on GR310. Navy diving equipment, book, training manuals. Phone Terry G8MQT (07073) 27233.
- Circuit diagrams, suitable 1920's Radio Case 10in x 8in x 7in and any information whatsoever on vintage receiver Chakophone No 1B three valve, desparate collector. All costs refunded immediately. A.J. Humphriss, 21 Gould Road, Hampton Magna, Warwick CV3 58TU.
- PLL Synth chip – Toshiba TC9105P as used in some synthesised SSB/AM/CB radios (Motorola) or equivalent or data etc. Tel: 0454 414423 after 6 pm (Bristol).
- Manual or copy for Tertronix 3A1 plug-in. Write to Mr. P. Alliott, 20 Windmill Avenue, Blisworth, Northampton, NN1 3EQ or Phone 0604 858467 evenings. or 0604 51720 daytime.
- Wanted solid state second hand oscilloscope 20 MHz dual beam. M. Zahid Mian. 1 Lexington Gdns, Sherwood. Nottingham, NG5 3FE. Tel: 624185 (Nott).
- Wanted 2 MTR Multimode transceiver: can offer new Yaesu FT 227 transceiver in box. Also a 12in cut power saw 'Frontier' (F35) 12 hours use only. Cost £150 last year: FDK TM56B 2MTR/Marine 16xtal receiver portable. Sort a swop from above or any ideas? As local to QTH as I'm Raibc Disable person. Mr. S.A. Buttle, 12 Badnam Close, Bursledon, Southampton. SO3 8EG. Tel: Bursledon 4333 (Hants).
- Racal RA17 receiver and HQ1 Minibeam. Phone Gavin, G4UCR, Selborne, (Hant)362.
- Xtals for 3200, need RB0 RB2 RB14 RB15 SU19. George G8WZN QTHR: Phone 0302 68339.
- Have you a faulty and unwanted HRO receiver? Reading School Amateur Radio Club are looking for one as a re-building project. Coils and Handbook would be welcome. Will collect. G4RSC Tel:Reading (0734) 61406 Daytime. 871330 Evenings.
- RCA 8122 valves. John Moxham G8KBQ, 22 Whiting Road, Windmill Hill, Glastonbury, Somerset. BA6 8HP. Tel:0458/33145 (daytime).
- HQ1, Also 2 or 3 ele Tribanders considered. Also Shure 526T or 444. Clive Field, 84 Ram Gorse, Harlow, Essex. CM20 1PZ. Tel:(0279) 28857.
- Empty tape recorder spools 5¾in diameter. Parker, 133 Station Road Cropston, Leicester LE7 7HH.
- Manual or circuit or anything helpful on Sylvania SC181W, your price paid. Mr H Lear, 86-205 Wensley Road, Reading, Berks.
- Wanted: GA8 and 6X5 metal valves close wartime period. Also required 1A4, 1A6, 1B5/255, IC6, IF4, IF6 or octal equivalents. Valves must be of USA origin. Telephone: Bath 891254.
- Components PCB and RF devices plus practical information on UHF Linear projects up to 900 MHz. This includes authorised self help television projects. Having used equipment up to 600 MHz with good results now find no available technology for higher freqs. Any help gratefully received and shared, including home made fibreglass parabolic aerial construction. D J Walsh (EI5CD), 17 Owenabue Rise, Carrigaline, Co. Cork, Ireland.
- Vic 20 – any cartridge software except – Superexp, Roadrace, Rat race, Voodoo Castle, Superslot, Omega Race, and EMI Music Composer. Will swap for any of above except Superexp. Also consider good utility/business/educational cassette software. Also required parallel (Centronics) printer interface and disc drive, working or not! Highcliffe (04252) 71794.
- Any information diagrams or parts for 19 set MkIII. Same for 62 set MkII in particular for 62 set ATU which is missing from the set. I have beginner looking for help please. A Armstrong, 1 Montfalcon Close, Peterlee, Co. Durham, SR8 1DD. Telephone: Peterlee 864500.
- GEC tube LD924E. Dennis Arthur Griggs, 5 Collingwood Ave, London, N10 3EH.
- Can anyone supply any information and and details on how to operate the battery TV-Radio set The Plustron TVR 5. Also an a (TVR 5) for mains use is wanted for this expenses paid by me. Mr N A G Mortim Ashbourne Road, Mitcham, Surrey, CR4 2B
- Receiver covering 50 to 500MHz Edd 770U AOR2001 or similar. Mk products SST PCB using seven 741 IC's. Microwave m receive converters for ATV and 136MHz collect reasonable distance. Please phone dlesbrough 0642 318451 after 6pm or weeke
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- Repair manual (or any help) for a H Shibaden VDU model VM-126K. Mr F B Honn York Road, Huyton, Liverpool, L36 1XB.
- Wanted the Dynamoter you removed from BC348 rcvr. Will pay £5 plus carriage for working specimen. N Kirk G3JDK, 54 Alle Road, Rotherham, Yorkshire, S65 3BY. Teleph Wickersley 541606.
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- Wanted for help: new brain users. Did you into the problem of write/read by using cass suggestions or more likely solutions wan Kanon J H PE1 HJJ, Kanaal WEG67 Den Hel Holland, 1782GD. Telephone: 02230-28031.
- Have telequipment S22 Oscilloscope. Wo swap for any UHF equipment suitable operation on D.Y (Derby) Repeater, scope c plete with mains adaptor cable and nicads, wo also consider microwave equipment or exten basic cartridge for TI99/4a, call G6TPZ on 2 met or write to Paul, 2 Mosley Drive, Uttoxeter, Sta ST14 7EY.
- Hitachi CSP600 Colour TV set connections tuner white and red wires. Simple diagr appreciated or where secondhand good worki order one could be obtained. Also where to lo for likely cause of lack of effective control brightness and contrast. Not a colour expert. Al would like to purchase at moderate price any ma dual STD B/W set in good working order. Mr T G Lever, 12 The Poplar's, Fovant, Salisbu Wiltshire, SP3 5LE. Telephone: Fovant (970) 686
- Wanted DR49 or DR31 receiver; offering DR plus cash adjustment. Telephone: 01-959-7715.
- Meccano wanted for young boy any conditi or age. Telephone: Ingrebourne 45969.
- G.N.Patchett's book – Colour Television – wi particular reference to the Pal system. 5th or late edition. Reasonable condition will pay reasonab price plus postage etc. Phone Allan GM6 PYD (03 336 4904.
- Wanted early valves, vintage radios, quad, lea Lowther valve amps and early quality Hi-Fi als Clandestine 'Spy-Set' receivers/transmitters an early Amateur radio equipment. Write to Joh Baker, 221 Portnall Road, London, W9 o Telephone: 450-6449.
- Wanted: computer and necessary software Write to 84745; PO Box 8, Southern Evening Echo Hythe, Southampton, Hampshire.
- KWATU or any similar ATU. Squeeze Keye dummy load 75Ω, LPF. Telephone Geoff on Reading 883508 or RDG 875123 ext 7631 office hours.
- Wanted High voltage variable capacitor 160pf or thereabouts – preferably surplus component from TU9 unit. Also Eddystone ceramic coil former. H M Humphreys Gi3EVU, 10 Mount Eden Park, Malone, Belfast, BT9 6RA. Telephone: 0232 668979.

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-5, GRC-109, AR-11, RS-6, RS-8, Delco 5300 and
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- Ross RE-8000 receiver. Schematic diagram or any other valuable data is needed. Will be paid or exchanged on your wish. Mr Franjo Bauk, A Pandakovica 15/II, 41000 Zagreb, Yugoslavia.
- FT101E with CW filter and G3LLL mixer £350. FRG7 with ambit FM board £150. Both mint in box G4HRY QTHR or telephone Coventry 618648.
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- The Microcomputer work group of the German amateur radio club is looking for public domain software of all subjects connected with amateur radio. Please contact DJ0JR with your offers. Model upload available. P J S Bendal/EMBL/Notkestr .85, 2000 Hamburg 52, West Germany.
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Reltech Instruments ...
RTVC ...

Sarel Electric Ltd ...
Scarab Systems ...
Selectronic ...
South Midlands Communicatons Ltd .. 42
Special Products Distribution Ltd ...
Stephen James Ltd ...
R & A Sudron Ltd ...
C R Supply Co ...

Texas Instruments Ltd ...
C-Tec Security ...
Thanet Electronics ... 10-

Waters & Stanton Electronics ...
Wood & Douglas ...

NEW IMPROVED
Radio & Electronics World
The communications, electronics & computers magazine

ADVERTISING RATES & INFORMATION

ABC membership approved pending first audit Jan-Dec 1984

DISPLAY AD RATES

			series rates for consecutive insertions		
depth mm x width mm	**ad space**	**1 issue**	**3 issues**	**6 issues**	**12 issues**
61 x 90	⅛ page	£91.00	£86.00	£82.00	£73.00
128 x 90 or 61 x 186	¼ page	£160.00	£150.00	£145.00	£125.00
128 x 186 or 263 x 90	½ page	£305.00	£290.00	£275.00	£245.00
263 x 186	1 page	£590.00	£560.00	£530.00	£475.00
263 x 394	double page	£1140.00	£1070.00	£1020.00	£910.00

COLOUR AD RATES

		colour rates exclude cost of separations	series rates for consecutive insertions		
depth mm x width mm	**ad space**	**1 issue**	**3 issues**	**6 issues**	**12 issues**
128 x 186 or 263 x 90	½ page	£420.00	£395.00	£375.00	£335.00
297 x 210	1 page	£810.00	£760.00	£730.00	£650.00

SPECIAL POSITIONS

Covers: Outside back cover 20% extra, inside covers 10% extra
Bleed: 10% extra [Bleed area = 307 x 220]
Facing Matter: 15% extra

DEADLINES

*Dates affected by public holidays

issue	colour & mono display ad	small ad	mono artwork	on sale
Mar 84	12 Jan 84	18 Jan 84	20 Jan 84	10 Feb 84
Apr 84	9 Feb 84	15 Feb 84	17 Feb 84	9 Mar 84
May 84	15 Mar 84	21 Mar 84	23 Mar 84	13 Apr 84
June 84	9 Apr 84*	16 Apr 84*	18 Apr 84*	11 May 84

CONDITIONS & INFORMATION

SERIES RATES
Series rates also apply when larger or additional space to that initially booked is taken.
An ad of at least the minimum space must appear in consecutive issues to qualify for series rates.
Previous copy will automatically be repeated if no further copy is received.
A 'hold ad' is acceptable for maintaining your series rate contract. This will automatically be inserted if no further copy is received.
Display Ad and Small Ad series rate contracts are not interchangeable.

If series rate contract is cancelled, the advertiser will be liable to pay the unearned series discount already taken.

COPY
Except for County Guides copy may be changed monthly.

No additional charges for typesetting or illustrations (except for colour separations).

For illustrations just send photograph or artwork.

Colour Ad rates do not include the cost of separations.

Printed — web-offset.

PAYMENT
All single insertion ads are accepted on a pre-payment basis only, unless an account is held.
Accounts will be opened for series rate advertisers subject to satisfactory credit references.
Accounts are strictly net and must be settled by the 15th of the month following invoice date.

Overseas payments by International Money Order.
Commission to approved advertising agencies is 10%.

CONDITIONS
A voucher copy will be sent to Display and Colour advertisers only.
Ads accepted subject to our standard conditions, available on request.

FOR FURTHER INFORMATION CONTACT
Radio & Electronics World, Sovereign House, Brentwood, Essex CM14 4SE.
(0277) 219876

COMTECH ELECTRONICS

TRANSISTORS

BC 107B	12p
BC 108C	12p
BC 109C	10p
BC 113/4	16p
BC 115/6	17p
BC 119	28p
BC 139	32p
BC 140	28p
BC 141	29p
BC 142	27p
BC 143	27p
BC 160	30p
BC 161	32p
BC 169C	8p
BC 171B	9p
BC 172C	9p
BC 173C	9p
BC 177B	15p
BC 178C	15p
BC 179	15p
BC 182	9p
BC 182B	9p
BC 183B	8p
BC 183C	9p
BC 184B	9p
BC 184C	9p
BC 212	9p
BC 212B	9p
BC 213B	8p
BC 213C	8p
BC 214B	9p
BC 214C	9p
BC 237	7p
BC 238	9p
BC 239	9p
BC 251	9p
BC 300	40p
BC 301	35p
BC 302	35p
BC 303	35p
BC 304	35p
BC 307	10p
BC 308	10p
BC 309	10p
BC 327	12p
BC 328	12p
BC 337	12p
BC 338	12p
BC 413C	10p
BC 414C	10p
BC 415C	10p
BC 416C	10p
BC 477	25p
BC 478	23p
BC 479	24p
BC 546	10p
BC 546B	10p
BC 547B	9p
BC 548B	9p
BC 548C	9p
BC 549C	9p
BC 550C	10p
BC 556	10p
BC 556B	10p
BC 557B	9p
BC 557C	9p
BC 558B	9p
BC 558C	9p
BC 559C	9p
BC 560C	10p
BC 637	20p
BC 638	20p
BC 639	23p
BC 640	24p
BCY 70	18p
BCY 71	18p
BCY 72	17p
BD 115	50p
BD 131	45p
BD 132	48p
BD 133	70p
BD 135	30p
BD 136	30p
BD 137	30p
BD 138	35p
BD 139	35p
BD 140	35p
BD 203	70p
BD 204	70p
BD 205	70p
BD 206	70p
BD 239A	40p
BD 239C	50p
BD 240A	42p
BD 240C	50p
BD 241A	42p
BD 241C	54p
BD 242A	42p
BD 242C	54p
BD 243A	55p
BD 243C	68p
BD 244A	64p
BD 244C	78p
BF 180	30p
BF 181	30p
BF 182	30p
BF 183	30p
BF 184	30p
BF 185	30p
BF 194	12p
BF 195	12p
BF 196	12p
BF 197	12p
BF 198	10p
BF 199	12p
BF 200	40p
BF 224	15p
BF 244C	22p
BF 245	25p
BF 256C	32p
BF 256LC	35p
BF 257	32p
BF 258	32p
BF 259	35p
BF 336	36p
BF 337	39p
BF 338	40p
BF 457	32p
BF 458	32p
BF 459	37p
BF 494	12p
BF 595	16p
BF 596	20p
BFX 29	28p
BFX 30	28p
BFX 84	28p
BFX 85	28p
BFX 87	27p
BFX 88	23p
BFY 50	23p
BFY 51	22p
BFY 52	22p
BSY 95A	23p
BU 205	140p
BU 206	150p
BU 208	140p
MJ 2500	230p
MJ 2501	**245p**
MJ 2955	**90p**
MJ 3000	**210p**
MJ 3001	225p
MJE 340	48p
MJE 350	70p
MJE 370	80p
MJE 371	84p
MJE 520	60p
MJE 521	68p
MJE 2955	80p
MJE 3055	68p
MPSA 05	20p
MPSA 06	20p
MPSA 12	22p
MPSA 13	22p
MPSA 42	23p
MPSA 43	23p
MPSA 55	20p
MPSA 56	20p
MPSA 63	22p
MPSA 64	22p
MPSA 92	24p
MPSA 93	24p
TIP 29A	30p
TIP 29B	33p
TIP 29C	33p
TIP 30A	30p
TIP 30B	33p
TIP 30C	36p
TIP 31A	33p
TIP 31B	35p
TIP 31C	37p
TIP 32A	33p
TIP 32B	35p
TIP 32C	37p
TIP 33A	55p
TIP 34A	60p
TIP 41A	46p
TIP 41C	60p
TIP 42A	46p
TIP 42C	60p
TIP 110	45p
TIP 115	45p
TIP 120	70p
TIP 121	70p
TIP 122	70p
TIP 126	70p
TIP 127	70p
TIP 2955	70p
TIP 3055	70p
TIS 44	20p
TIS 90	24p
TIS 92	20p
2N1613	30p
2N1711	30p
2N1893	30p
2N2218	24p
2N2218A	25p
2N2219	24p
2N2219A	25p
2N2221A	20p
2N2222	18p
2N2222A	20p
2N2368	23p
2N2369A	15p
2N2484	24p
2N2646	48p
2N2904	22p
2N2904A	23p
2N2905	23p
2N2906A	22p
•2N2907	23p
2N2907A	25p
2N3053	23p
2N3054	56p
2N3055	50p
2N3055H	75p
2N3440	58p
2N3441	120p
2N3442	120p
2N3702	10p
2N3703	10p
2N3704	10p
2N3705	10p
2N3706	10p
2N3707	10p
2N3708	10p
2N3771	170p
2N3772	170p
2N3773	190p
2N3819	20p
2N3823	50p
2N3866	95p
2N3903	10p
2N3904	10p
2N3905	10p
2N3906	10p
2N4030	**30p**
2N4033	**30p**
2N4037	**40p**
2N4058	**7p**
2N4059	**10p**
2N4060	**10p**
2N4061	10p
2N4062	10p
2N4400	15p
2N4401	15p
2N4402	15p
2N4403	15p
2N5400	18p
2N5401	20p
2N5457	28p
2N5458	27p
2N5459	25p
2N5460	38p
2N5550	18p
2N5551	20p
2N6027	23p
2N6028	23p

ZENERS

400 mW	
2V7-36 V	6p
1.3 W	
4V7-51 V	10p

THYRISTORS

C 106D	28p
C 116D	70p
C 126D	90p
C 126M	98p
MCR 101	30p
MCR 102	34p
T 2800D	110p
T 2800M	165p
2N4443	120p
2N4444	130p
2N5060	23p
2N5061	24p
2N5062	29p
2N5064	32p

TRIACS

C 206	55p
C 225D	60p
C 226D	70p
C 226M	90p
C 236	90p
C 236M	120p
C 246D	98p
C 246M	140p
BR 100	30p

BRIDGE RECTIFIERS

W 005	18p
W 01	20p
W 02	22p
W 04	24p
W 06	28p
W 08	32p
3A/50V	40p
3A/100V	42p
3A/200V	44p
3A/400V	46p
6A/50V	75p
6A/100V	80p
6A/200V	88p
6A/400V	94p
25A/100V	185p
25A/200V	198p
25A/400V	220p

LED's

3mm red	8p
5mm red	8p
3mm green	11p
5mm green	11p
3mm yellow	11p
5mm yellow	11p
clips	3p
rectangular	
Red	10p
Green	14p
Yellow	14p

CMOS

4000	14p
4001	14p
4002	14p
4006	50p
4007	16p
4008	50p
4011	14p
4012	15p
4013	24p
4014	54p
4015	46p
4016	24p
4017	42p
4018	47p
4019	30p
4020	46p
4021	42p
4022	46p
4023	14p
4024	38p
4025	14p
4026	84p
4027	29p
4028	42p
4029	48p
4030	18p
4035	56p
4040	48p
4041	48p
4042	42p
4043	44p
4044	44p
4046	55p
4048	30p
4049	25p
4050	25p
4051	52p
4052	52p
4053	54p
4066	28p
4068	15p
4069	15p
4070	15p
4071	15p
4072	15p
4073	15p
4074	15p
4075	15p
4077	15p
4078	15p
4081	15p
4082	15p
4093	32p
4098	78p
40161	52p
40162	52p
40163	52p
4501	16p
4502	55p
4503	34p
4504	98p
4506	70p
4508	145p
4510	50p
4511	52p
4512	48p
4513	98p
4514	110p
4516	55p
4517	180p
4518	52p
4520	55p
4522	65p
4526	64p
4528	56p
4529	72p
4530	92p
4531	70p
4532	88p
4541	70p
4544	120p
4551	88p
4553	180p
4554	148p
4555	48p
4556	48p
4557	160p
4558	110p
4559	390p
4560	170p
4566	120p
4568	270p
4569	140p
4572	42p
4573	198p
4574	198p
4575	198p
4580	280p
4584	38p
4585	74p
4599	178p

IC SOCKETS

8 pin	8p
14 pin	9p
16 pin	10p
18 pin	11p
20 pin	14p
22 pin	14p
24 pin	19p
28 pin	24p
40 pin	20p
SPECIAL OFFERS	
25 x 22 pin	270p
25 x 28 pin	340p
10 x 40 pin	185p
25 x 40 pin	440p

CPU IC's

6800	395p
6802	550p
6808	520p
6810	250p
6820	250p
6821	190p
6840	595p
6850	180p
6852	360p
6880	140p
6885	130p
6889	140p
68000 POA	
8T26A	140p
8T28	120p
8T95	140p
8T97	140p
8T98	140p
8080A	400p
8085A	500p
8156C	600p
8212C	198p
8216C	140p
8224C	220p
8228C	450p
8251AC	495p
8253AC	800p
8257C	750p
8259C	900p
8288	£16
TMS9980A	£22
TMS9981N	£25
TMS9901N	590p
TMS9902N	550p
Z80A 4M	580p
Z80A P10	500p
Z80A DMA	£16
2101-4A	350p
2114-4	120p
2147-70nS	600p
214745nS	700p
2716	400p
4164-150nS	£10
4016-200nS	£7
5101LC	340p
5101LC-1	395p

VOLTAGE REGULATORS

Positive	
100mA	
78L05	30p
78L12	30p
78L15	30p
78L18	45p
78L24	45p
1 A TO220	
7805	40p
7808	40p
7812	40p
7812	40p
7818	40p
7824	40p
5 A TO3	
78H05	540p
Negative	
100 mA	
79L05	50p
79L12	50p
79L15	50p
1 A TO220	
7905	45p
7906	65p
7908	65p
7912	55p
7915	55p
7924	65p
--Variable--	
LM 309K	120p
LM 317K	250p
LM 317T	98p
LM 337T	180p
LM 350T	395p
LM 723CN	35p
78H05	540p

OPTO

TIL 32	55p
TIL 38	40p
TIL 78	50p
TIL 100	100p
TIL 111	85p
2N5777	50p
4N25	80p
4N28	70p
4N33	128p
4N35	150p
4N37	100p
BPX 38	390p
BPX 43	340p
TIL 221	20p
(high output clear red)	

LINEAR IC's

CA 3046	72p
CA 3065	190p
CA 3080	72p
CA 3086	56p
CA 3089	170p
CA 3090AQ	300p
CA 3130E	95p
CA3140E	**44p**
CA 3160E	**100p**
CA 3161E	**140p**
CA 3240AE	**165p**
CA 3240E	110p
CA 3260E	100p
CA 810QM	250p
LF 347	160p
LF 351	45p
LF 353	80p
LF 355	85p
LF 356	88p
LF 357	110p
LM 301A	26p
LM 307	54p
LM 311	60p
LM 318	120p
LM 324	40p
LM 339	46p
LM 348	60p
LM 358	48p
LM 380	68p
LM 380-8	80p
LM 381	140p
LM 381	120p
LM 384	125p
LM 386	**90p**
LM 387	135p
LM 393	70p
LM 555	**18p**
LM 556	45p
LM 565	100p
LM 567	150p
LM 709	35p
LM 710	70p
LM 711	60p
LM 733	75p
LM 741	**15p**
LM 747	50p
LM 748	35p
LM 1458	36p
LM 3900	47p
MC 1455	**18p**
MC 1458	34p
MC 1496	70p
MC 1748	35p
MC 3302	72p
MC 3401	68p
MC 3403	65p
NE 529	220p
NE 531	160p
NE 532	56p
NE 544	200p
NE 550	160p
NE 555	16p
NE 556	45p
NE 558	170p
NE 565	**140p**
NE 560	**150p**
NE 567	**140p**
NE 570	**395p**
NE 571	**395p**
NE 644	**P.O.A.**
NE 645	**P.O.A.**
RC 4558	48p
SAA 1027	**650p**
SAA 1056	495p
SAA 5000	350p
SAA 5010	**750p**
SAA 5020	620p
SAA 5030	£10
SAA 5040	£18
SAA5041	£25
SAA5050	£10
SAA5052	£10
SL490	300p
SN 76115	98p
SN 76660	90p
TBA120S	70p
TBA520Q	200p
TBA550	240p
TBA570Q	200p
TBA625	100p
TBA800	70p
TBA810AS	95p
TBA810S	95p
TBA820	75p
TBA820M	78p
TBA920	195p
TBA950	210p
TCA270	120p
TCA800	250p
TCA940	180p
TDA1022	550p
TDA1024	130p
TDA2002	**190p**
TDA2003	**220p**
TDA2004	**470p**
TDA2005M	395p
TDA2006	325p
TDA2020	250p
TDA2030	220p
TDA2040	450p
TDA2054M	130p
TL061	40p
TL062	80p
TL064	120p
ULN 2001	80p
ULN 2003	80p
ULN 2004	80p

ORDERING INFORMATION: Please add **40p** P&P to all orders under **£6**, then VAT to total order. Cheques or postal orders made payable to Comtech Electronics. Official orders welcome, trade please enquire. All items held in stock despatched same day. SAE brings full list. Data sheets **10p** each.

CAPACITORS

Electrolytic radial/axial.

Value/	V	price
0.47	25	5p
0.47	63	6p
1 μF	63*	6p
2.2	16	5p
2.2	63*	6p
4.7	25	6p
4.7	63*	6p
10 μF	10	5p
10 μF	16	6p
10 μF	25*	6p
10 μF	63*	7p
22 μF	16	6p
22 μF	25	6p
22 μF	63*	9p
47 μF	10	7p
47 μF	25	8p
47 μF	63	12p
100	10*	6p
100	16	8p
100	25	10p
100	63	18p
220	10*	8p
220	16	10p
220	25*	14p
220	63	24p
470	10	14p
470	25*	20p
1000	10	18p
1000	25*	28p
2200	10	32p
2200	25*	45p

* axials only available these values, radial available on all of above.

Tantalum bead.

Value/	V	price
0.1 μF	35	12p
0.22	35	12p
0.33	35	12p
0.47	35	12p
0.68	35	12p
1 μF	35	12p
2.2 μF	35	16p
3.3 μF	35	18p
4.7 μF	25	20p
6.8 μF	25	20p
10 μF	16	20p
15 μF	16	28p
22 μF	16	35p
33 μF	16	60p
33 μF	10	36p
47 μF	10	60p
68 μF	10	80p
60 μF	6.3	60p
100μF	6.3	70p
100μF	3	38p
150μF	6.3	90p

Ceramic Plate 63/100 V 1.8 pF to 4N7 **5p**.

Polystyrene 5% 63 V: 10 pF to 1 nF **9p** each. 1n2 to 10 nF **12p** each.

Polyester C352 series 250 V 0.01, 0.015, 0.022, 0.033, 0.047 **6p**. 0.068, 0.1 **8p** 0.15, 0.22 **10p** 0.33, 0.47 **12p** 0.68 **18p**. 1 μ **22p**.

Disc Ceramic: 10 N **4p**

DIODES

AA 119	9p
BAX 13	5p
BAX 16	6p
OA 47	9p
OA 90	7p
OA 91	7p
OA 95	8p
OA 200	7p
OA 202	8p
1S44	6p
1S921	9p
1N914	3p
1N916	4p
1N4148	3p
1N4149	4p
1N4001	3p
1N4002	4p
1N4003	4p
1N4004	5p
1N4005	5p
1N4006	6p
1N4007	6p
1N5401	11p
1N5402	12p
1N5403	13p
1N5404	13p
1N5405	14p
1N5406	14p
1N5407	15p
1N5408	16p
6A/100V	25p
6A/200V	28p
6A/400V	30p

HEATSINKS

TO5 push on 6mm (80°C/W) **16p** each. 12mm (60°C/W) **28p** each. TO3 14°C/W **50p** each. TO3 10°C/W **110p** each. TO126/220 18°C/W **25p**. All in matt black finish.

RESISTORS

¼ Watt Carbon film 5% E 24 series 4.7 R-2M2 **1p** each. ½ Watt Carbon film 5% E 12 series 1R-10M **2p** each. ¼ Watt Metal film 1% E 24 series 10R-1M **4p** each. **250p** per 100, one value only. **280p** per 100 mixed values. 2.5 Watt wire-wound OR22-10 ohms E12 series **25p each.** Presets: miniature horizontal & vertical **8p** each 100R-500K. Multiturn cermet trimmers 100R-500K **88p** each. Potentiometers: Single gang 1K to 1M **43p** each. Single gang with DPST switch **68p** each. Dual gang **80p** each.

VEROBOARD

2½ x 1"	25p
2½ x 3¾"	90p
2½ x 5"	110p
3¾ x 3¾"	110p
3¾ x 5"	115p
Pkt of 100 pins	55p
Spot face cutter	150p

HARDWARE

each

4xTO3 mounting kits **20p** 64 mm Loudspeakers 8R **70p** 4xTO66 mounting kits **20p** 64R **78p** each. 300mW rating. 5 xTO126 bushes/washers **14p** PP3 battery snaps **6p** each. 10xTO220 bushes/washers **22p** 4xHP7 battery holder **22p** 5 xTO3P bushes/washers **14p** 6xHP7 battery holder **32p** 20mm panel fuseholder **32p** 20mm chassis fuseholder **7p** 4mm plugs **12p**. 4mm sockets **20p.** 4mm insulated terminals **30p.** 3.5mm jack socket **15p.** 3.5mm jack plug **15p** Phono sockets **15p**. Switches: miniature toggle, SPST **60p**, SPDT **68p**, DPDT **78p** each. Miniature push buttons: 1A/250V push to make **16p**. push to break **23p**. Midget rotary switches, pcb terminals 2P6W, 4P3W, 3P4W **39p** each. Slide switch 1A/250V DPDT (22 x 12 x 8 mm) **16p.**

BRAND NEW COMPONENT PACKS

CP100 60 IC sockets, 8, 14, and 16 pin, 20 of each	**440p**
CP101 20 BC182/BC212 transistors, 10 of each . .	**130p**
CP102 20 BC183/BC213 transistors, 10 of each . .	**100p**
CP103 20 BC184/BC214 transistors, 10 of each . .	**130p**
CP104 20 BC549C/BC559C transistors, 10 of each	**130p**
CP105 20 BC550C/BC560C transistors, 10 of each	**160p**
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CP108 100 1N4148 switching diodes, 75-100V/75mA	**160p**
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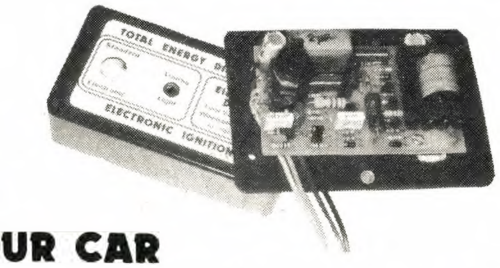

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- ★ Is it **EASY TO START** in the cold and the damp? Total Energy Discharge will give the most powerful spark and maintain full output even with a near flat battery.
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LOADED OUTPUT VOLTAGE
50pF load — 38kV, 50pF + 500k — 26kV

We challenge any manufacturer to publish better performance figures. Before you buy any other make, ask for the facts, its probably only an inductive system. But if an inductive system is what you really want, we'll still give you a good deal.

- ★ **All ELECTRONIZE electronic ignitions feature: EASY FITTING, STANDARD/ELECTRONIC CHANGEOVER SWITCH, STATIC TIMING LIGHT and DESIGNED IN RELIABILITY (14 years experience and a 3 year guarantee).**
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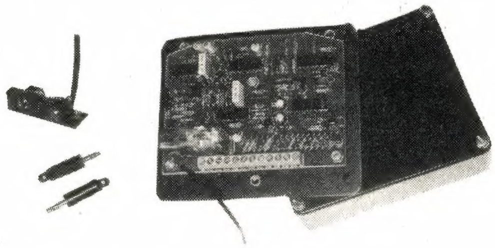
Most **NEW CARS** already have electronic ignition. Update **YOUR CAR**

ELECTRONIZE ELECTRONIC CAR ALARM



HOW SAFE IS YOUR CAR ?

More and more cars are stolen each week and even a steering lock seems little help. But a car thief will avoid a car that will cause him trouble and attract attention. If your car has a good alarm system - well there are plenty of other cars to choose from.

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- ★ **2025 INDIVIDUAL COMBINATIONS** The key plug contains two 1% tolerance resistors, both must be the correct value and together give 2025 different combinations.
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- ★ **30 SECOND EXIT DELAY** The system is armed by pressing a small button on a dashboard mounted control panel. This starts a 30 second delay period during which the owner can open and close doors without triggering the alarm.
- ★ **10 SECOND ENTRY DELAY** When a door is opened a 10 second delay operates to allow the owner to disarm the system with the coded key plug. Latching circuits are used and once triggered the alarm can only be cancelled by the key plug.
- ★ **L.E.D. FUNCTION INDICATOR** An LED is included in the dashboard unit and indicates the systems operating state. The LED lights continuously to show the system is armed and in the exit delay condition. A flashing LED indicates that the alarm has been triggered and is in the entry delay condition.
- ★ **ACCESSORY LOOP - BONNET/BOOT SWITCH - IGNITION TRIGGER** These operate three separate circuits and will trigger the alarm immediately, regardless of entry and exit delays.
- ★ **SAFETY INTERLOCK** The system cannot be armed by accident when the engine is running and the car is in motion.
- ★ **LOW SUPPLY CURRENT** CMOS IC's and low power operational amplifiers achieve a normal operating current of only 2.5 mA.
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CAR ALARM (12 volt negative earth)

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